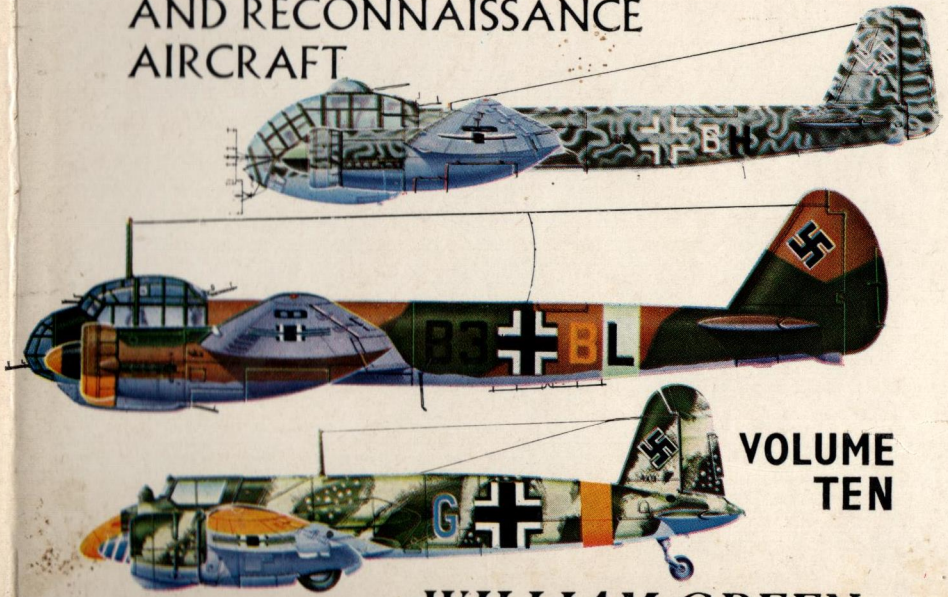
WAR PLANES OF THE SECOND WORLD WAR

BOMBERS

AND RECONNAISSANCE AIRCRAFT



VOLUME TEN

WILLIAM GREEN

BOMBERS AND RECCE ACFT. VOL. 10

DOUBLEDAY

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WAR PLANES OF THE SECOND WORLD WAR

by

William Green

Volume X

BOMBERS AND RECONNAISSANCE AIRCRAFT

Volume Ten is the fourth in a series of volumes to be devoted to land-based aircraft employed during the Second World War for bombing, reconnaissance or army co-operation, irrespective of age or importance, as well as those aircraft that were being actively developed for such tasks by the various combatants during 1939–1945.

Cover illustrations (top to bottom): Junkers Ju 188D-2 of 1.(F)/124 (Kirkenes, Norway, April 1944); Junkers Ju 88A-4 of I/KG 54 "Totenkopf" (Gerbini, Sicily, April 1942); Henschel Hs 129B-2 of 4. (Pz)/Sch. G.1 (Russian Front, Winter 1942–43).

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With Drawings by Dennis I. Punnett

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INTRODUCTION

One of the most fascinating aspects of historical research of any kind is the inevitability of new facts emerging if the researcher delves into his chosen subject in sufficient depth; facts which, as often as not, explode the most cherished beliefs and theories, and reveal as fallacious information derived from what were previously considered impeccable sources. In no field of historical research does this apply more profoundly than in that of aviation, and in particular to the period covered by the years of the Second World War.

Nothing is more fallible than the human memory, and though a mere 23 years have elapsed since that greatest of all conflicts ended, few of those that participated can recall clearly more than generalities, these sometimes being punctuated by incidents which, having deeply impressed the individual, may be totally recalled. However, the passage of time and subsequent experiences colour recollections. What aircraft designer will admit, when looking back, that his incompetence rather than inefficient employment was primarily responsible for the failure of an aircraft in combat; what pilot will accept that his inadequacy rather than the shortcomings of his aircraft led to the failure of a mission.

Thus the conscientious historian cannot rely solely on the memories of those that played an active role in the field that he is researching. These must have the supporting evidence of contemporary written or photographic material if their recollections are to be considered beyond dispute. I recall all too clearly being taken to task by an internationally-known test pilot for having referred to his testing an aircraft which he declared most vociferously never to have seen let alone flown. When presented with a photographic copy of a flight test report of this same aircraft bearing his signature, he half-heartedly admitted that his memory was not what it was.

Much spurious information published during the war years, and enjoying widespread credence even today as a result of constant repetition, stemmed from the demands of propaganda or the withholding of the true facts for reasons of security. Even more spurious information has been published since the war, however, as a product of ignorance, inadequate research, and a lack of readily available documentation, and the wartime aircraft progeny of no country have suffered so much from inaccurate presentation than those of Germany. Errors of fact first perpetrated in the early postwar years by certain German writers motivated by financial reward rather than any desire to portray their subject accurately have been perpetuated and elaborated upon, until now there is a plethora of published material on the aircraft utilised by or developed for the *Luftwaffe* during the Second World War, and much of it totally valueless.

Fortunately, many authentic records believed destroyed during or immediately after the war but, in fact, buried in archives for more than two decades are being progressively brought to light, and an immensely fruitful source of fact they are proving to be, enabling the genuine historian to reassess and correct much previously considered irrefutable fact.

Few more intriguing portions of the overall picture of German aircraft development in the immediate pre-war and wartime years now revealed is offered than that presented by the pioneering and prolific Junkers Flugzeug und Motorenwerke, whose bomber and reconnaissance aircraft progeny occupy the bulk of the pages of this volume. Best known for its Ju 87 dive-bomber, for long the most notorious of

warplanes, and the Ju 88, which, for ubiquity and versatility, came second to none, Junkers devoted much of its attention to the progressive development of these basic types whose versions were almost infinite in their variety. In parallel, Junkers evolved the Ju 288 which, despite its type number, bore no relationship to the Ju 88 other than a common origin, and after its own fashion achieved a measure of notoriety; the world's first heavy jet bomber, the unique Ju 287, and a long-range maritime patrol and reconnaissance-bomber, the Ju 290 derived from a commercial transport which, itself, stemmed from a heavy bomber.

Junkers was also responsible for the first pressurized high-altitude aircraft to attain operational service, the Ju 86P, but this Dessau-based organization was not alone in its pioneering interest in pressurized warplanes for operation at extreme altitudes, this being shared by the Henschel Flugzeugwerke whose Hs 130 series of high-altitude aircraft are also described in this volume. In view of Junkers' experience in the design and development of heavy long-range aircraft, it is not surprising that when the so-called *Amerika-Bomber*, an aircraft capable of attacking New York from European bases, should be considered, the organization developed the Ju 390, one of the largest aircraft to be flown during the Second World War.

Another contender for orders as the *Amerika-Bomber* was the Me 264, a product of the Messerschmitt concern, better known for its fighter aircraft, which shares the closing pages of this volume with the pulse-jet-powered Me 328, a single-seat attack bomber product of a period in which the deteriorating war situation had engendered in Germany a situation in which the most unorthodox proposals for combating the forthcoming Allied landings on the Continent were given the most serious consideration.

Like the two earlier volumes in which the remainder of this survey of German bomber and reconnaissance aircraft appears, the following pages cover almost exactly a decade of development, commencing with the initial trials of the first prototypes of the Ju 86 and Ju 87 in late 1934 and mid-1935 respectively, and terminating with the début of such advanced warplanes as the Ju 287, recording both success and failure. Numerous hitherto unpublished photographs are included among the illustrations of this volume, and in this respect I should like to record my gratitude to Hans Redemann who has supplied several of the photographs, to the Bundesarchiv, Coblenz, for the photographs appearing on page 19, 64, 66 (top), 71 (top), 72, 80, 94 (top), 95, to Hans Obert for the photograph appearing on page 60 (top); to Bo Widfeldt for the photographs on page 39, and to Julius Gaal for the photograph appearing on page 79.

London, January 1968 William Green

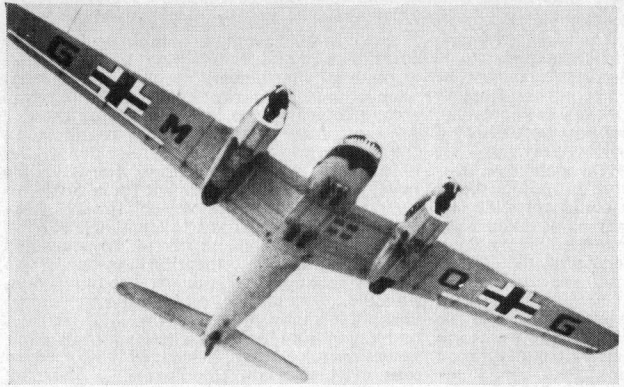
By the summer of 1944, the *Schlachtflieger*, the specialist close-support formations, were without doubt the all-important element of the *Luftwaffe* committed to the Russian Front. Insofar as the *Luftwaffe* was concerned, its operational sorties in the East were directed primarily against the Soviet Army. As the *Wehrmacht* went over to the defensive, this emphasis became even more pronounced, for only anti-tank aircraft could provide an effective answer to the massed Russian tank formations.

Unfortunately for the *Luftwaffe*, short-sightedness on the part of the *Luftwaffenführungsstab* and the *Oberkommando der Luftwaffe* (OKL), was largely responsible for the inability of the *Schlachtflieger* to introduce on a large scale the one aircraft really suited to and designed for close-support and anti-tank tasks, the Henschel Hs 129. Not that the Ob.d.L. had failed to foresee the potentialities of direct support sufficiently early, but it did fail to appreciate fully the extent of its importance and to ensure that sufficient impetus was placed behind the development of aircraft designed specifically for the task.

Admittedly, the term *Schlachtflieger* did not appear in Germany's basic handbook on the principles of aerial warfare, the *Luftwaffen Dienstvorschrift*, issued in 1935, the Ob.d.L. then being of the opinion that any intervention of aircraft in a land battle would have more moral than military effect. Some modification of this viewpoint resulted from a realistic evaluation of early aerial warfare in the Spanish conflict, however, and in the spring of 1937, the *Technische Amt* of the RLM was ordered to draft a basic requirement for a *Schlachtflugzeug*; a relatively small but heavily armed and armoured aircraft intended specifically for the direct support of ground forces. In the event, a combination of low priority and poor handling characteristics stemming from the very nature of the aircraft were to result in protracted gestation, and some five years were to elapse before the end product of the *Schlachtflugzeug* requirement, the Hs 129, was to make its service début.

In April 1937, the *Technische Amt* issued its newly-formulated requirement for a *Schlachtflugzeug* to the Hamburger Flugzeugbau, Focke-Wulf, Gotha and Henschel. Apart from specifying the use of two low-powered engines, minimal dimensions in order to present as small a target to ground fire as possible, 75-mm. armourglass glazing for the cockpit, armour protection for both engines and crew, and a fixed forward-firing armament of at least two 20-mm. MG FF cannon plus machine guns, the *Technische Amt* left the manufacturers to which the requirement had been issued with a relatively free hand. The submissions by the four contenders were made by October 1, 1937, and after evaluation by the *Technische Amt*, the Focke-Wulf and Henschel proposals were accepted, both companies being awarded design development contracts.

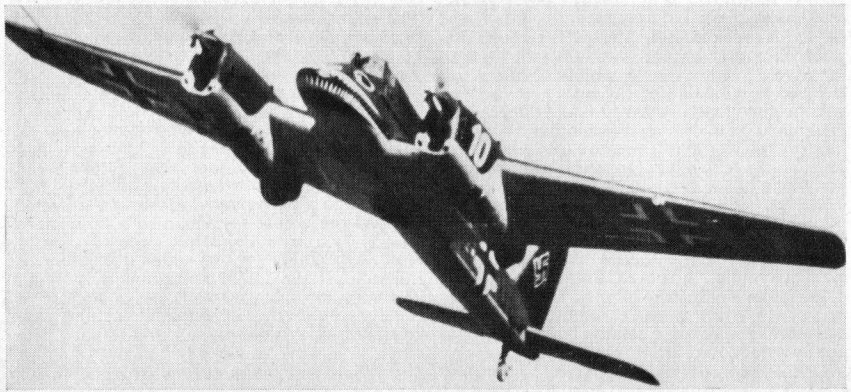
The *Technische Amt* had envisaged a single-seat aircraft although this had not been stipulated, and the fact that Focke-Wulf's proposal called for two crew members was not viewed with favour. However, despite a marked preference for Henschel's appreciably smaller single-seat project, the *Technische Amt* was intrigued by the possibility of utilizing all the major components, with the exception of the central fuselage nacelle, of the Fw 189 tactical reconnaissance and army co-operation monoplane. At that time, detail design of the Fw 189 had been finalised and metal was being cut on prototypes, and

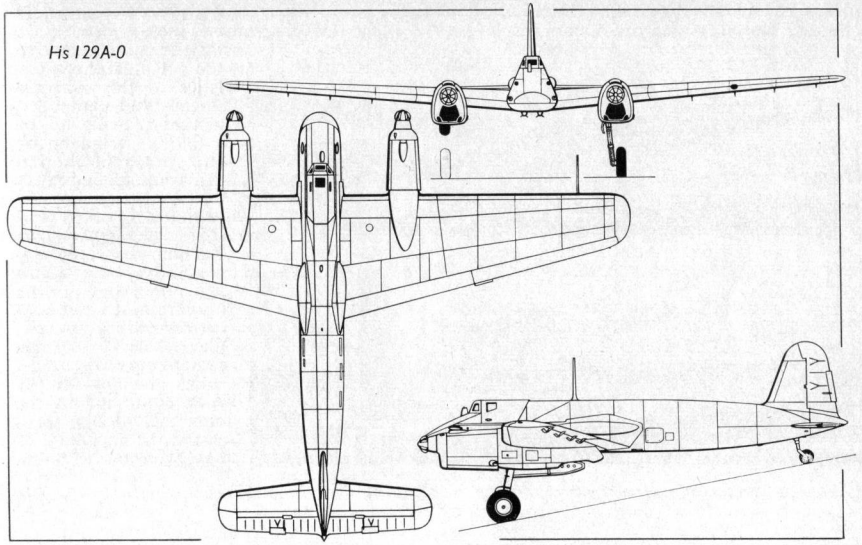


it was agreed that Focke-Wulf should evolve an interchangeable close support fuselage nacelle.

Mock-up inspections were carried out in the spring of 1938. The *Technische Amt* agreed to Dipl.Ing.Kurt Tank's proposal that the Fw 189 V1 should be adapted for the close-support role after the completion of initial handling

(*Left and below*) *An Argus-powered Hs 129A-0.*



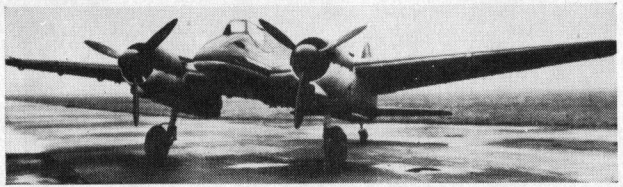


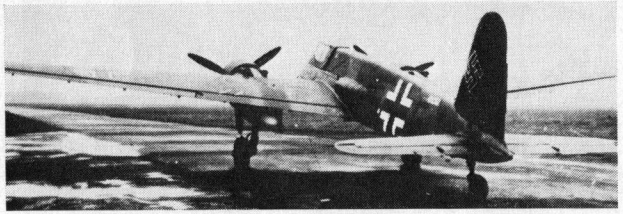
trials in tactical reconnaissance form, but considered Henschel's mock-up of what had now received the RLM designation Hs 129 unsatisfactory in several respects. A revised mock-up was therefore built by Henschel and, after two further inspections, each of which resulted in revisions, the company received orders in mid-1938 to commence the construction of three prototypes.

The first Henschel prototype, the **Hs 129 V1**, was completed and flown in the spring of 1939, by which time the Focke-Wulf contender for the close-support contract, the Fw 189 V1b, had begun manufacturer's trials. The results achieved with the Fw 189 V1b left much to be desired, and the aircraft was soon to be returned to the experimental shop for major modifications in preparation for competitive trials with the Hs 129 V1.

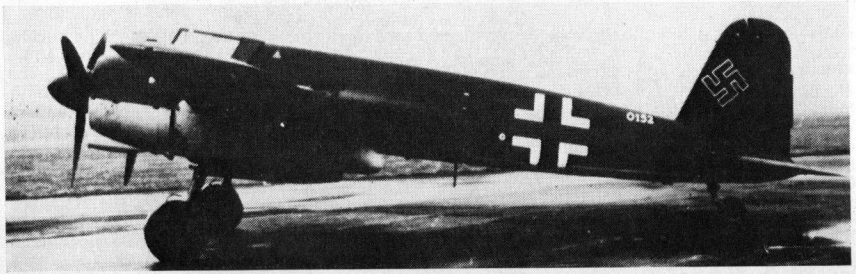
In the meantime, Focke-Wulf had been awarded a contract for a single prototype of the close-support version of the Fw 189, the V6, which was now viewed by the RLM as nothing more than a back-up programme in the event of the Henschel design proving a total failure, and to the order for three

prototypes of the latter had been added a contract for eight pre-production machines. In the event, when the Hs 129 V1 commenced its flight test programme, there proved to be little to choose between the flying characteristics of this and the Focke-Wulf contender, neither proving to be a pilot's aeroplane by any stretch of the imagination. Comparative trials between the prototypes held at the *Erprobungsstelle* Rechlin appeared inconclusive, the RLM test pilots finding little favourable to say concerning either aircraft. Nevertheless, work on the pre-production series of eight **Hs 129 A-0**s continued as the Henschel design possessed the advantage of being cheaper to build.





(*Above and below*) *The second pre-production Hs* 129*B*-0 (*Werk-Nr.* 0152) *completed at Schönefeld late* 1941. *Note enclosed gun blast tubes.*



The first prototype of the Hs 129 was joined in the flight test programme during the summer of 1939 by the **Hs 129 V2** and **V3**, and at the end of the year the first pre-production Hs 129A-0 was completed, the remaining seven following during the early months of 1940. Of small overall dimensions, the Hs 129 possessed a fuselage of triangular cross section. The centre and aft sections were of light metal stressed-skin construction, the former being built integrally with the two-spar wing centre section, and marrying up to an armoured shell forming the fuselage nose and accommodating the pilot. The floor and nose of the shell were built up from 12-mm. welded armour plate and the sides from 6-mm. plate. The sliding canopy enclosing the pilot was also of 6-mm. plate with diminutive 75-mm. armourglass panels providing a measure of forward and lateral vision.

So small were the dimensions of the cockpit that there was insufficient room on the instrument panel for all the engine instruments, a number of these having to be mounted on the inner faces of the engine nacelles themselves, and the extremely limited depth necessitated the use of an unusually short control column which demanded an inordinate amount of effort on the part of the pilot for even the simplest of manoeuvres.

The wing centre section carried the engine nacelles which were protected by 5-mm. armour plate and housed the main undercarriage members, the single-leg units retracting hydraulically backwards to leave a portion of each wheel protruding from the well. Like the centre section, the outer wing panels were two-spar all-metal stressed-skin structures, and the entire wing trailing edge was hinged, the outer sections acting as slotted ailerons and the inner sections as slotted flaps. A fuel tank of 44 Imp. gal. capacity was housed in the fuselage aft of the cockpit, and two 45 Imp. gal. tanks were mounted between the spars of the wing centre section. Armament comprised two 7.9-mm. MG 17 machine guns in the lower forward fuselage, and two 20-mm. MG FF cannon in the fuselage sides, their breeches enclosed by bulged metal fairings over the wing root trailing edges.

Power was provided by two Argus As 410A-1 12-cylinder inverted-Vee air-cooled engines each rated at 465 h.p. for take-off and 415 h.p. at 7,875 ft., but from the outset of the flight test programme it was manifestly obvious that the aircraft was seriously underpowered, even without weapons. It proved sluggish in the air, acceleration was poor, and manoeuvrability was marginal, but the principal complaint voiced by the test pilots was the totally inadequate view from the cockpit. Service trials were begun in the late autumn of 1940 by 5.(*Schlacht*)/*Staffel* of *Lehrgeschwader* 2, and as a result of these the *Luftwaffe* flatly refused to accept the proposed production model, the **Hs 129A-1**, which apart from minor modifications, was intended to be essentially similar to the pre-production Hs 129A-0.

The Hs 129 had been designed by a team led by Dipl. Ing. Friedrich Nicolaus who had, in the meantime, projected a slightly scaled-up development of the basic design, the **P.76**, intended to utilize more powerful Gnôme-Rhône 14M small-diameter 14-cylinder radial air-cooled engines which had become available with the defeat of France. Featuring a redesigned and more extensively glazed cockpit canopy, the P.76 bid fair to rectify all the principal shortcomings of the Hs 129, but Henschel had already prepared much jigging and tooling for the Hs 129, and the RLM, now loath to accept the further delays that would inevitably result from the introduction of what was to all intents and purposes an

entirely new design, instructed Dipl. Ing. Nicolaus to investigate the possibility of marrying the Gnôme-Rhône engine to the existing Hs 129 airframe. Accordingly, two of the pre-production Hs 129A-0s were returned to Henschel for trial installations of the French engines, the remaining Hs 129A-0s later serving alongside several Hs 129Bs with the *Schlachtflieger* training unit, 4./SG 101, at Paris–Orly.

HENSCHEL HS 129B

Despite the fact that the Gnôme-Rhône engine possessed a weight almost twice that of the Argus and was appreciably bulkier than the German power plant, the conversion of the Hs 129 airframe to take the French radial presented no insurmountable difficulties, calling for some minor structural changes to the wing centre section and the repositioning of some items of equipment to maintain the c.g.

The Gnôme-Rhône 14M 4/5 engines each offered 700 h.p. for take-off and 660 h.p. at 13,200 ft., and the two airframes converted at Henschel's Schönefeld plant to take these radials were, after hurried manufacturer's trials, ferried to the *Erprobungsstelle* Rechlin for official evaluation. The more powerful engines markedly improved the performance of the close-support aircraft, despite the substantial increase in weight, and acceleration was now considered acceptable, although handling qualities still left much to be desired and stick forces were anything but satisfactory. However, the main complaint voiced by Rechlin pilots was the inadequate vision provided from the cockpit. This had been one of the worse features of the Argus-powered model, and had worsened with the application of the Gnôme-Rhônes.

The successes enjoyed by the Hs 123A biplanes of II(*Schlacht*)/LG 2 during the Polish and French campaigns had by now impressed on the Ob.d.L. the importance of direct close support in land battles, and it was also becoming appreciated that the Junkers Ju 87, the "bird-in-hand", could be considered as nothing more than an interim *Schlachtflugzeug*. Thus, with the decision in mid-1941 to expand the *Schlachtflieger*, the Hs 129 programme, which had struggled along with only desultory official enthusiasm and little sense of urgency, was suddenly allocated the highest priority. Henschel was ordered to prepare for the immediate quantity production of the Gnôme-Rhône-powered model at Schönefeld, despite its apparent shortcomings, satisfying the complaints of the Rechlin test pilots as best the company could without delaying service deliveries.

Designated the **Hs 129B**, the Gnôme-Rhône 14M-engined version introduced a more extensively glazed armoured cockpit canopy previously tested on the Hs 129 V3, some modification of the control surfaces and rearrangement of the electrically-actuated trim tabs to reduce stick forces, and revised built-in armament, the two MG FF cannon of the Hs 129A-0 giving place to a pair of MG 151s of similar calibre with 125 r.p.g. The two 7.9-mm. MG 17 machine guns with 500 r.p.g. were retained, and provision was made for the application of a series of special *Rüstsätze* (equipment or armament sets) by unit maintenance personnel as and when the operational situation demanded.

The first example of a pre-production batch of 10 **Hs 129B-0** aircraft (*Werk-Nr.*0151) was completed at Schönefeld late in December 1941. Three more were delivered in January 1942, with a further three in February, while in March the last three Hs 129B-0s left the assembly line in company with the first three production Hs 129B-1s. The **Hs 129B-1** differed from the B-0 only in minor respects,

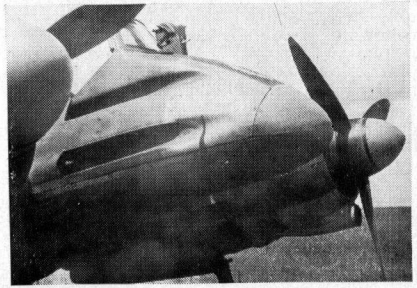
such as the replacement of enclosed blast tubes by open troughs, the redesign of the carburettor air intake, and the repositioning of the radio equipment. Production tempo promised to rise rapidly, and no fewer than 31 Hs 129B-1s were completed in April, but modifications dictated by initial service usage coupled with delays in the delivery of components from sub-contractors rapidly made themselves felt on the assembly line, and no comparable monthly output was destined to be achieved once more until October in which 33 aircraft were delivered.

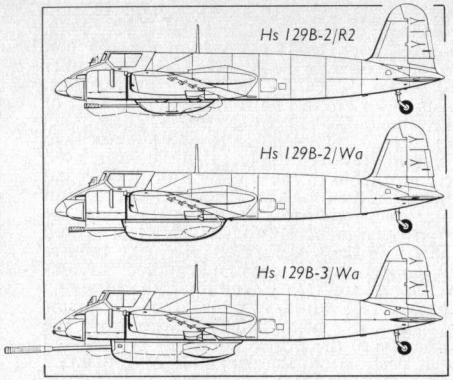
The urgency attached to the service introduction of the Hs 129B may be gauged from the fact that the pre-production Hs 129B-0s and the first Hs 129B-1s were hurriedly issued to 4.*Staffel* of the new *Schlachtgeschwader* 1 which had been activated in January 1942. Based at Lippstadt in North-West Germany, 4./Sch.G.1 was quickly worked up to operational status and, with 12 Hs 129B-1s on strength, left for the Eastern Front on May 10, 1942. Even before the arrival in Russia of the Hs 129Bs of 4./Sch.G.1, the shortcoming that was to prove the Achilles Heel of this close-support aircraft had begun to reveal itself—the poor reliability of the Gnôme-Rhône 14M engine. Apart from a disconcerting tendency to seize without warning, the Gnôme-Rhône proved incapable of absorbing any but the most trivial battle damage, and was particularly sensitive to dust and sand. As soon as 4./Sch.G.1 arrived on the South Russian steppes serviceability dropped disastrously, and a further five months were to elapse before the Hs 129B-1 could be issued to other units, frenzied attempts being made in the meantime to eradicate the engine's shortcomings and to rectify other teething troubles revealed by the initial service use of the aircraft on the Eastern Front.

The second Hs 129B-equipped unit, 4./Sch.G.2 formed with 12 aircraft at Deblin-Irena in Poland on September 30, 1942, enjoyed even less success than did the first *Staffel* to operate the Henschel. On November 10, 1942, 4./Sch.G.2 left for North Africa, losing four aircraft en route, and only four of the remaining eight aircraft proved operational on arrival. The Gnôme-Rhône engines then promptly revealed the fact that they were even less amenable to the ingestion of desert sand than the dust of the Russian steppes, and after two or three operations, during the course of which two aircraft were lost behind the Allied lines as a result of engine failures and maintenance personnel failed to improvise a satisfactory sand filter, the surviving aircraft were withdrawn to Tripoli for major overhaul, this being still in process when the approach of the British 8th Army necessitated their destruction, the personnel of 4./Sch.G.2 being evacuated to Bari without aircraft.

By the end of 1942, a total of 219 Hs 129B-0 and B-1 aircraft had been completed by the

Blast troughs and Revi sight of Hs 129B-1/R2. Note early-type dust filters.





Schönefeld factory, but the assembly line was plagued with constant demands for modifications and delays in deliveries of power plants and equipment, and these combined to prevent a peak monthly output of 40 machines being exceeded. This output, which was eventually to be attained in June 1943, could only be maintained with difficulty until the following November, despite the ever-increasing demands of the *Schlachtflieger*, production subsequently falling off and the total of 414 Hs 129Bs manufactured during 1943 being less than half the number programmed. Indeed, only a further 225 were to be completed in the following year, all production being cancelled at the end of September 1944 in favour of the "emergency fighter programme". Thus, excluding the prototypes and eight Hs 129A-0s, total production only amounted to 859 aircraft.

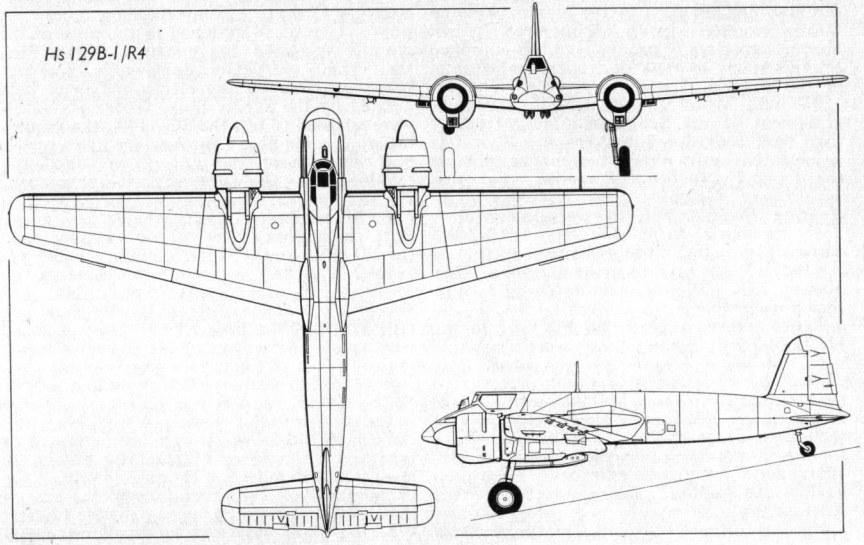
With the arrival of the Hs 129B in service, *Luftwaffe* pilots were disappointed to discover that their new mount was barely 20 m.p.h. faster than the Ju 87D, and decidedly inferior in manoeuvrability, facts which, coupled with poor engine reliability, hardly augured well for its popularity. However, the Hs 129B did possess an extraordinarily sturdy fuselage, offered its pilot effective protection against ground fire, and enjoyed some versatility in the weapons loads that it could carry.

The standard four-gun built-in armament was aimed by means of a Revi C 12/C gunsight offset to starboard immediately in front of the windscreen, and racks were provided beneath the outboard wing panels for a pair of 110-lb. SC 50 bombs or two packs each containing 24 4.4-lb. SD 2 anti-personnel bombs, and an Rb 24 automatic camera was fitted. The following alternative *Rüstsätze* could accompany the standard installations: (R2) One 30-mm. MK 101 cannon with 30 rounds in a detachable ventral pack; (R3) four uncowled 7.9-mm. MG 17 machine guns slung beneath the fuselage with a total of 1,000 rounds of ammunition housed in a bay on the fuselage port side; (R4) racks beneath the fuselage for four 110-lb. SC 50 bombs, four packs each containing 24 SD 2 anti-personnel bombs, or one 551-lb. SC 250 bomb, and (R5) an internally-mounted Rb 20/30 battle reconnaissance camera.

The MK 101 cannon was intended primarily for use against armoured vehicles, and while 4./Sch.G.2 was forming at Deblin-Irena in September 1942, *Jagdgeschwader* 51 was forming a so-called *Panzerjäger Staffel* on MK 101-equipped Hs 129B-1/R2 aircraft, this specialized anti-tank unit joining combat on the Eastern Front in January 1943. Although some successes were achieved against Russian armour, the MK 101 was incapable of penetrating the 45-mm. plate of the T-34 or the 75-mm. plate of the KV-1, and Pz.Jäg./JG 51 took to using 8.8-lb. SD 4 hollow-charge

bombs while more effective anti-tank weapons were being brought to a sufficient state of reliability for service use.

Another *Staffel*, 8./Sch.G.1, had been formed at Lippstadt and sent to the Eastern Front to where 4./Sch.G.2 had been transferred after its evacuation from Tripoli and subsequent re-equipment, and a fifth Hs 129B-equipped *Staffel*, 5./Sch.G.2, had been established with former JG 27 and JG 53 personnel and sent to Tunis-El Aouina, but high attrition and the Schönefeld factory's inability to boost production tempo had prevented further units being formed on the Hs 129B by October 10, 1943, when the *Schlachtflieger* underwent major reorganisation. All five Hs 129B-equipped *Staffeln* were gathered together in a new *Gruppe*, IV (*Panzer*)/*Schlachtgeschwader* 9, under the command of *Hauptmann* Bruno Meyer, but 10 days later, 11.(Pz)/SG 9 (the former 8./Sch.G.1.) was withdrawn from the Eastern Front to Udetfeld to serve as a development unit, eventually becoming *Erprobungskommando* 26 (EKdo 26) on January 10, 1944. The task of this unit was the development and testing of new anti-tank



weapons and tactics in close collaboration with the Roggenthin satellite of the *Erprobungsstelle* Rechlin, the *Waffenprüfplatz* Tarnewitz, and the Henschel and Rheinmetall-Borsig concerns.

Production of the Hs 129B-1 had, in 1943, given place at Schönefeld to the **Hs 129B-2** which embodied as standard the various modifications made progressively on the Hs 129B-1 in the light of operational experience. Initially, the Hs 129B-2 could be equipped with the same *Rüstsätze* as its predecessor, and thus, for example, the Hs 129B-2/R2 carried the 30-mm. MK 101 cannon, but with the alarming increase in the size of Russian tank formations being encountered it had become necessary to use the Hs 129B-equipped *Staffeln* solely as tank destroyers rather than in the general close-support role. The Hs 129B was therefore fitted with anti-tank armament at the Schönefeld factory rather than with provision for alternative *Rüstsätze* to be fitted by forward maintenance units as the tactical situation demanded, and was accordingly designated **Hs 129B-2/Wa** indicating *Waffenträger*, or weapon-carrier.

In its basic form, the Hs 129B-2/Wa carried a similar built-in armament to that of the B-1, and the initial version carried a single 30-mm. MK 103 cannon in a ventral fairing, this possessing a higher muzzle velocity and a flatter trajectory than the MK 101 of the Hs 129B-2/R2. Some aircraft were also fitted with the BK 3.7 anti-tank gun of 37-mm. calibre, the installation of which necessitated the deletion of the two MG 17 machine guns in the lower portion of the fuselage centre section in order to provide additional space for the 37-mm. shell magazine. Both the MK 103 and BK 3.7 proved efficacious when used against the "softer" sides and rear of the Russian tanks.

Various other anti-tank weapons were tested by the Hs 129B-equipped *Staffeln*, these including the 210-mm. Wfr. Gr. 21 and 280-mm. Wfr. Gr. 28 rocket tubes, the 70-mm. *Panzerblitz* 1 and 55-mm. *Panzerblitz* 2 rockets, and even a pack containing a *Gero* flame-thrower with 66 Imp. gal. of fuel. But one of the most original anti-tank weapons evaluated was the SG 113A *Förstersonde* (Ranger Probe) automatic mortar tested at Tarnewitz by EKdo 26. The SG 113A comprised a rhomboid-shaped container in which six individual mortars were mounted vertically, each mortar accommodating a single shell with a 77-mm. soft metal jacket and a 45-mm. armour-piercing core. A photo-electric cell attached to the nose of the aircraft triggered the mortars which fired their shells vertically downwards, the cell being actuated by the electro-magnetic field created by the enemy tank. Three Hs 129Bs were adapted to test the SG 113A, the mounting protruding above the fuselage like a turret, but this weapon did not prove sufficiently reliable during the Tarnewitz trials to warrant operational use.

By the beginning of 1944, the *Schlachtflieger* were demanding larger calibre weapons than the 30-mm. and 37-mm. cannon of the Hs 129B-2/Wa, and consideration was given to the adaptation of the 75-mm. PaK 40L *Panzerabwehrkanone* for use by the Henschel. One Hs 129B-2 (*Werk*-Nr.141258) was fitted with a wooden mock-up of a large ventral housing and a PaK 40 cannon for aerodynamic trials which commenced at Travemünde in May 1944. These proved the feasibility of the installation of this immense weapon, and three Hs 129B-2/Wa aircraft were adapted to take the PaK 40 and tested by EKdo 26 against captured Soviet tanks while the installation was "productionized" for use by the **Hs 129B-3/Wa.** For use by the Hs 129B-3/Wa, the PaK 40L was modified in several

HENSCHEL HS 129B-2 SPECIFICATION

Type: *Single-seat Close Support and Anti-Tank Aircraft.* **Power Plants:** *Two Gnôme-Rhône 14M 4/5 14-cylinder radial air-cooled engines each rated at 700 h.p. for take-off and 660 h.p. at 13,200 ft.* **Armament:** (*Standard*) *Two 7.9-mm. MG 17 machine guns with 500 r.p.g. and two 20-mm. MG 151 cannon with 125 r.p.g., plus one 30-mm. MK 101 cannon with 30 rounds, four 7.9-mm. MG 17 machine guns with 250 r.p.g., four 110-lb. SC 50 bombs, 96 4.4-lb. SD 2 anti-personnel bombs, or one 551-lb. SC 250 bomb beneath fuselage, and two 110-lb. SC 50 bombs or 48 4.4-lb. SD 2 bombs beneath wings.* (*Hs 129B-2/Wa*) *Standard built-in gun armament and one 30-mm. MK 103 cannon or two 20-mm. MG 151 cannon and one 37-mm. BK 3.7 cannon.* **Performance:** *Maximum speed* (*without external load*), *253 m.p.h. at 12,570 ft.;* (*with 30-mm. MK 103 cannon*), *199 m.p.h. at 9,845 ft.; cruising speed* (*without external load*), *196 m.p.h. at 9,845 ft.; range* (*without external load*), *428 mls.*, (*with 30-mm. MK 103 cannon*), *348 mls.; initial climb rate* (*without external load*), *1,595 ft./min.; service ceiling* (*without external load*), *29,530 ft.*, (*with 30-mm. MK 103 cannon*), *24,600 ft.* **Weights:** *Empty, 8,400 lb.; empty equipped* (*without external pack*), *8,860 lb.*, (*with 30-mm. MK 103 cannon*), *9,243 lb.; maximum loaded, 11,574 lb.* **Dimensions:** *Span, 46 ft. 7 in.; length, 31 ft. 11¾ in.; height* (*to top of airscrew arc*), *10 ft. 8 in.; wing area, 312.153 sq. ft.*

respects. A large muzzle recoil brake was fitted and electro-pneumatic operation replaced mechanical operation, and in this form the weapon was redesignated BK 7.5. The cannon was provided with 12 26-lb. rounds, rate of fire being 40 rounds per minute, and thus, after closing to a distance of 110 yards from the tank, the pilot could loose off four shells in one firing pass. The exhaust gases were ejected rearwards and the entire pack could be jettisoned in an emergency. After firing trials by EKdo 26 during August–September 1944, some two dozen Hs 129B-3/Wa anti-tank aircraft with BK 7.5 cannon left the Schönefeld assembly line before the entire Hs 129 production programme was abandoned. These, retaining their 20-mm. MG 151 cannon but dispensing with the 7.9-mm. MG 17s, were delivered to 10. and 14.(Pz)/SG 9 (the former 4./Sch.G.1 and Pz.Jäg./JG 51) and operated on the Eastern Front during the winter of 1944–45.

HENSCHEL HS 129C

At a relatively early stage in the production life of the Hs 129B, Dipl. Ing. Nicolaus, casting around for an alternative power plant to the troublesome Gnôme-Rhône 14M, prepared a study for a version with two Isotta-Fraschini Delta RC 16/48 12-cylinder inverted-Vee air-cooled engines rated at 840 h.p. at 17,390 ft. Designated **Hs 129C**, this variant was to have carried a pair of 30-mm. MK 103 cannon mounted side-by-side in a ventral installation designed to possess limited traverse. A mock-up of this installation was extensively tested, but the Delta engine suffered protracted development delays, and as adequate deliveries of this power plant could not be assured, the Hs 129C was abandoned, no example of this variant being completed.

OPERATIONAL CAREER

The poor showing of the first Hs 129B-equipped *Staffeln* in action, 4./Sch.G.1 in Russia and

An Hs 129B-3/Wa with a 75-mm. BK 7.5 anti-tank cannon. It will be noted that the troughs for the 7.9-mm. MG 17 machine guns were faired over but that the 20-mm. MG 151 cannon were retained.

4./Sch.G.2 in North Africa, had no effect on the *Luftwaffe*'s plans to equip additional units with this close support aircraft as soon as these became available, and within three weeks of the evacuation of 4./Sch.G.1, minus its aircraft, from Tripoli, 8./Sch.G.2 had become operational on the Hs 129B-1 at Tunis–El Aouina under the control of the *Fliegerführer Tunis*. First-line strength fluctuated between seven and 16 aircraft, and in May the *Staffel* was withdrawn to Decimomanu, Sardinia, from where it operated under the *Fliegerführer Sardinien* until, in July, it was transferred to the Eastern Front to join forces with 8./Sch.G.1, 4./Sch.G.2, and the special tank-destroyer *Staffel*, Pz.Jäg./JG 51, plus the original Hs 129B unit, 4./Sch.G.1.

All five Hs 129B *Staffeln* were now concentrated against Russian armour under the control of the *Führer der Panzer Jäger*, and early in July 1943, four of these *Staffeln* participated in the German offensive launched under the code-name "Operation Citadel". The Hs 129Bs were operating from Mikoyanovka under the overall command of *Hauptmann* Bruno Meyer, and on July 8, 1943, three days after the all-out German attack on the Kursk salient had begun, a Soviet armoured brigade, intent on making a flank attack on the II *SS Panzerkorps*, was sighted West of Byelgorod. The four Hs 129B *Staffeln*, each with 16 aircraft, attacked from astern and abeam in relays, as one *Staffel* attacked another was en route to the target, a third was refuelling and re-arming at Mikoyanovka, and the fourth had made its attack and was returning to base to refuel for the next sortie. The brigade scattered in complete confusion, the bulk of its tanks being destroyed while the accompanying infantry were decimated by anti-personnel bombs dropped by Fw 190 units.

In the late autumn of 1943, Colonel Ernst Kupfer was appointed the first *Waffengeneral der Schlachtflieger*, and on October 10, when the *Schlachtflieger* underwent major reorganization, all five Hs 129B-equipped *Staffeln* were combined to form the IV/(*Panzer*) *Gruppe* of *Schlachtgeschwader* 9, the individual *Staffeln* being redesignated as follows: 4./Sch.G.1 became 10.(Pz)./SG 9, 8./Sch.G.1 became 11.(Pz)./SG 9, 4./Sch.G.2 became 12.(Pz)./SG 9, 8./Sch.G.2 became 13.(Pz)./SG 9, and Pz.Jäg./JG 51 became 14.(Pz)./SG 9. Although 11.(Pz)./SG 9 was shortly afterwards pulled back to Germany to serve as a development unit, the remaining four *Staffeln*, together with the three squadrons of the 8th Ground Attack Wing of the Royal Rumanian 1st Air Corps, which, operating under *Luftflotte* 4, had now been equipped with the Hs 129B, roamed freely over the territory covered by *Luftflotten* 4 and 6, attacking targets of opportunity and breaking-up Russian tank concentrations.

Although the Gnôme-Rhône engines remained troublesome, serviceability progressively improved, attaining some 70 per cent except after periods of exceptionally intense activity. During periods of extreme cold the large-calibre guns frequently failed to function, and by June 1944, the petrol shortage was beginning to curtail the operations of the Hs 129B *Staffeln* with the result that concentrations of Soviet tanks frequently went unmolested. During the last months of 1944, 10. and 14.(Pz)./SG 9 introduced the BK 7.5-equipped Hs 129B-3/Wa, but although this immense weapon could knock out even the mighty *Josef Stalin* tank with one shot, the aircraft was extremely ponderous and vulnerable. Sorties were practically confined to attempts to knock out Soviet tank elements that had already broken through and were roaming behind the *Wehrmacht*'s lines, this being dictated not only by the fuel situation but by the desperate straits in which the *Wehrmacht* now found itself. By the beginning of 1945, IV(Pz)/SG 9 had dwindled in strength to two *Staffeln* (10 and 14), and as operational losses mounted and replacements diminished, the Hs 129 gradually faded out of service.

The so-called "Infanterie-Sturmabzeichen", the assault emblem, which appeared on the armoured nose of all Hs 129s of the Schlachtflieger.

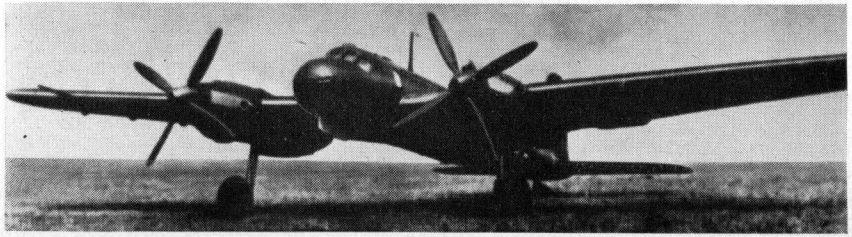
During 1938, Dr. Seewald of the *Deutsches Versuchsanstalt für Luftfahrt* (DVL) at Berlin-Adlershof approached Dipl. Ing. Fr. Nicolaus, chief designer of the Henschel Flugzeugwerke, with proposals concerning the joint design and development of a high-altitude research aircraft suitable for testing pressure cabins and DVL-developed turbo-superchargers. Design studies were prepared in close collaboration between the DVL and Henschel, and, with the blessing of the *Forschungsabteilung* or Research Department of the *Reichsluftfahrtministerium* (RLM), work began on the construction of two prototypes of the high-altitude aircraft under the designation Hs 128.

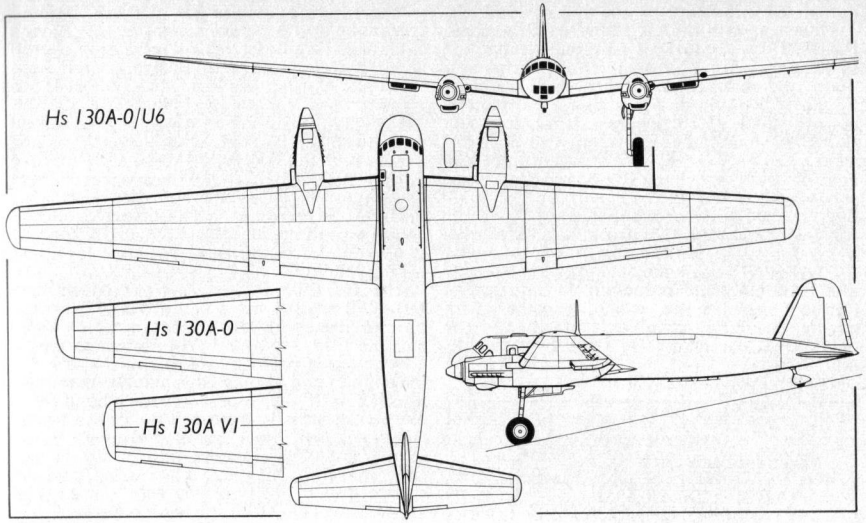
The original scheme called for the first prototype, the **Hs 128 V1**, to be powered by two Daimler-Benz DB 601 engines fitted with DVL-developed TK 9 exhaust-driven superchargers with which it was anticipated that the aircraft would operate for protracted periods at altitudes above 29,500 ft., while the second prototype, the **Hs 128 V2**, powered by Junkers Jumo 210 engines with two-stage TK 16 superchargers, was expected to attain altitudes in excess of 50,000 ft.

The Hs 128 was an all-metal low-wing cantilever monoplane, the stressed-skin single-spar high aspect ratio wing of constant taper having a span of 85 ft. 4½ in., and the circular-section stressed-skin fuselage being 48 ft. 5½ in. in overall length. The pressure cabin, evolved jointly by DVL and Henschel, provided accommodation for two crew members and maintained an atmospheric pressure corresponding to that at 8,200 ft. This cabin was of the so-called "hot-wall" type and formed a separate structure within the fuselage, being carried by a mounting ring midway along its length. The shell was of riveted construction, being built up from thin duralumin sheet, heat insulation being provided by aluminium foil and hot air being circulated between the pressure cabin walls and the forward fuselage structure proper. A line of small double-glazed windows provided forward vision for the crew members, and the undercarriage was of fixed, spatted type.

Both prototypes were completed in 1939,

The Hs 130A V1, the first of three prototypes of the initial Henschel high-altitude reconnaissance aircraft.





initial flight trials being conducted without the exhaust-driven superchargers, but a wealth of useful data was obtained on pressure cabins, and the two prototypes subsequently undertook considerable testing of both DVL- and Hirth-developed superchargers with DB 601 and DB 605 engines, and various power-boosting systems, including methanol-water injection and nitrous-oxide injection.

HENSCHEL HS 130A

Although the Hs 128 suffered continuous troubles with its power plants, its high altitude potentialities soon attracted the attention of Theodor Rowehl of the *Aufklärungsgruppe/Oberbefehlshaber der Luftwaffe*, the special long-range reconnaissance unit attached to the High Command. Rowehl suggested to the RLM that the Hs 128 could be developed for operation by his unit as a high-altitude reconnaissance aircraft, and, his proposal enthusiastically received, Henschel received instructions to adapt the basic design for the reconnaissance role under the designation **Hs 130A**, contracts being awarded for three prototypes and seven pre-production examples.

Work on the Hs 130 proceeded with extreme rapidity, and all three prototypes had been

completed and flown by the end of 1940. By comparison with the Hs 128 research aircraft, the Hs 130A prototypes featured a reduction in wing span to 72 ft. 6 in., fully-retractable main undercarriage members, and provision in the rear fuselage for a pair of remotely-controlled Rb 75/30 cameras. It was intended that power should be supplied by two Daimler-Benz DB 601D 12-cylinder liquid-cooled engines with mechanically-driven two-stage superchargers but, in the event, the DB 601D had attained an insufficient stage of reliability for installation in the prototypes, Henschel being forced to replace this power plant by the DB 601R with a single-stage supercharger and a consequent reduction in anticipated altitude performance which, together with engine teething troubles, precluded the operational use of the Hs 130A by Rowehl's unit.

HENSCHEL HS 130A-0/U6 SPECIFICATION

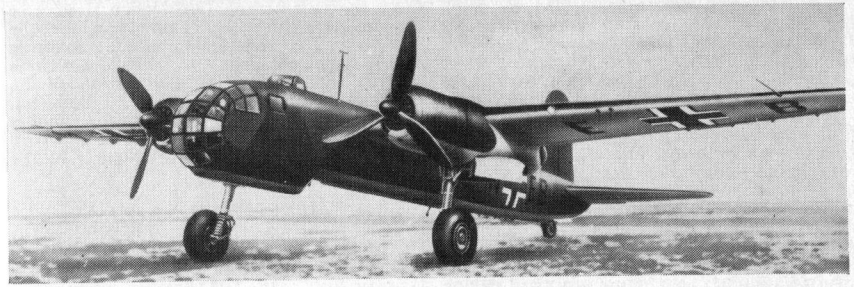
Type: *Two-seat High-Altitude Reconnaissance Aircraft.* **Power Plants:** *Two Daimler-Benz DB 605B 12-cylinder liquid-cooled engines each rated at 1,475 h.p. for take off.* **Armament:** *None.* **Performance:** *Maximum speed,* 261 *m.p.h. at* 19,685 *ft. without GM* 1 *boost,* 292 *m.p.h. at* 19,685 *ft. with GM* 1 *boost; range (with drop tanks),* 1,385 *mls. including* 335 *mls. at* 280 *m.p.h.* at 44,290 *ft., (without drop tanks),* 870 *mls.; maximum endurance at* 44,290 *ft.,* 3 *hr.; maximum ceiling with GM* 1, 50,850 *ft.* **Weights:** *Normal loaded,* 24,650 *lb.; maximum loaded,* 25,750 *lb.* **Dimensions:** *Span,* 95 *ft.* 1¾ *in.; length,* 49 *ft.* 0½ *in.; height (to airscrew tips),* 16 *ft.* 1 *in.; wing area,* 876 *sq. ft.*

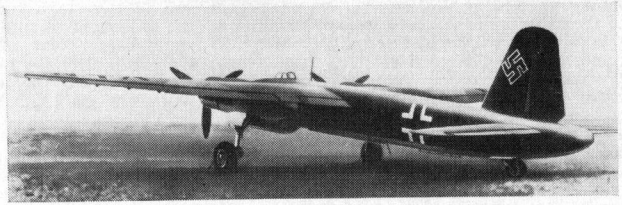
The pre-production **Hs 130A-0** differed from the prototypes primarily in having extended wing outer panels increasing overall span to 83 ft. 8 in., and all five aircraft were delivered during the first half of 1941 to Echterdingen for testing and development. Modifications were continuously introduced as a result of the concentrated efforts on the part of both the DVL and Henschel to improve altitude performance, the necessary changes being undertaken by the so-called Lufthansa Werft of Echterdingen. The ultimate modification was designated **Hs 130A-0/U6**, the first two examples of which were ready for flight testing late in November 1943.

The Hs 130A-0/U6 was powered by two DB 605B engines rated at 1,475 h.p. for take-off and fitted with Hirth 2281A superchargers and the GM 1 power boost system in which nitrous oxide provided additional oxygen for the engines and also acted as an anti-detonant. Injected into the superchargers, the nitrous oxide substantially increased the power of the engines above their rated altitudes. Wing span was further increased to 95 ft. 1¾ in., 1,825 lb. of nitrous oxide was carried, and the internal fuel capacity of 556 Imp. gal. housed in four tanks ahead of the wing main spar was supplemented by a pair of 66 Imp. gal. drop tanks. The crew complement remained two members and the pair of Rb 75/30 cameras was retained.

HENSCHEL HS 130B

Early in 1941, Henschel proposed a high-altitude bomber version of the Hs 130A under the designation **Hs 130B**. Retaining the Hs 130A airframe, the proposed bomber differed from the reconnaissance aircraft solely in having the camera installation replaced by a bomb-bay capable of accommodating up to 2,205 lb. of bombs. A mock-up of the Hs 130B was completed by Henschel but the





(Above) The Hs 130C V2 and (right) Hs 130C V1. Neither of these prototypes was fitted with the remotely-controlled barbettes.

difficulties being experienced by the Hs 130A with its power plants at this stage motivated against proceeding with the bomber variant, and the project was abandoned.

HENSCHEL HS 130C

Despite its type number, the Hs 130C bore little relationship to any other aircraft bearing the Hs 130 designation apart from a common design bureau, and the retention of this number was the result of an effort on the part of the Development Department of the RLM to hide from the *Führungsstab der Luftwaffe* the fact that it was widening the "Bomber B" programme to take in yet another competitor. The "Bomber B" programme called for a twin-engined aircraft with pressurized accommodation for a crew of three or four and remotely-controlled defensive armament, and the RLM had agreed with the *Führungsstab* that the specification should be issued to only four manufacturers—Arado, Dornier, Focke-Wulf and Junkers. However, in view of the importance of the programme, and realizing that Henschel possessed more experience in the development of high-altitude aircraft than any of the existing competitors, the RLM urged Henschel to evolve an aircraft meeting the requirements of the specification yet being ostensibly a progressive development in the existing Hs 130 series.

The Henschel design team, led by Dipl. Ing. Fr. Nicolaus, initiated work on the Hs 130C late in 1940. Of all-metal stressed-skin construction, the Hs 130C was intended to be powered by two DB 603AAMs with large superchargers and methanol-water injection, and the need to provide accommodation for four crew members coupled with an ample field of view both fore and aft, and provision for remotely-controlled defensive armament, necessitated major departures in the design of the pressure cabin from that utilized by the Hs 130A. A rigid air-tight structure was adopted with external stiffening members and four attachment points marrying with tubular strutted supports resembling a normal engine mounting. Owing to the rather complex form of the cabin and the heavy stresses to which it was to be subjected, the external stiffening was reinforced by a welded elektron framework. Electrically-controlled gun barbettes each mounting a pair of 13-mm. MG 131 machine guns and designed by Rheinmetall-Borsig were positioned above and below the pressurized cabin, with siting positions immediately aft of the upper barbette and at the rear of the ventral step. Provision was also made for a single remotely-controlled 7.9-mm. MG 15 machine gun in the extreme tail.

Three prototypes of the Hs 130C were ordered, the first two of which, the **Hs 130C V1** (NX-EA) and **V2** (MN-EB), flying late in 1942 with BMW 801A 14-cylinder radial air-cooled engines driving three-blade airscrews. Later, during the summer of 1943, the Hs 130C V2 was re-engined with turbo-supercharged BMW 801J radials driving four-blade airscrews. Neither of the first two prototypes were fitted with the remotely-controlled barbettes, but the **Hs 130C V3** (KN-ED) which flew early in 1943 with DB 603A engines carried full armament.

By the summer of 1943, when it became obvious that all other contenders for the "Bomber B" requirement were suffering serious technical problems, discussions were initiated concerning the production of an initial series of 100-130 **Hs 130C-1** bombers, but before the end of 1943, the entire "Bomber B" programme had been abandoned and with it all plans for the series production of the Hs 130C.

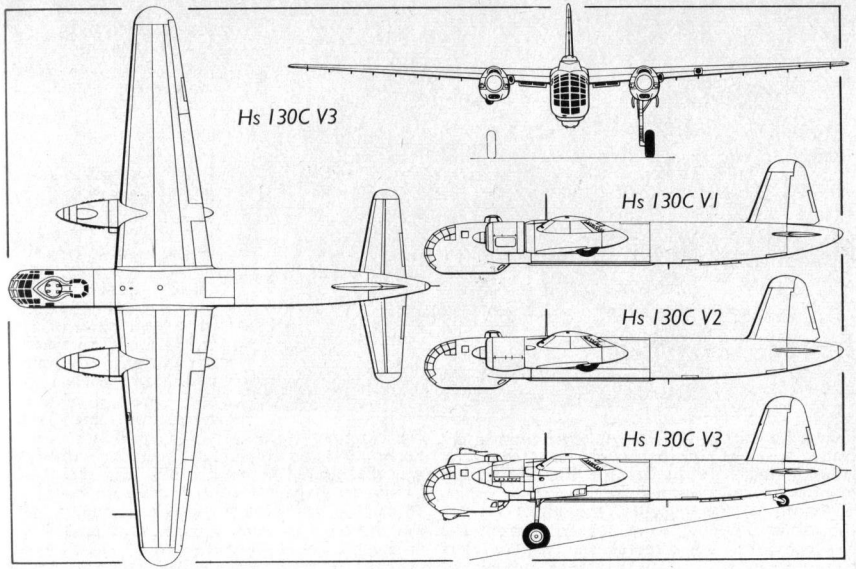
HENSCHEL HS 130D

In 1941, plans were formulated to produce the **Hs 130D**, a version of the Hs 130A high-altitude reconnaissance aircraft powered by Daimler-Benz DB 605 engines fitted with special two-stage superchargers designed by the DVL and manufactured by Argus. The supercharger was of exceptionally complex type and, after the failure of bench tests, the RLM ordered the adandonment of further work, the Hs 130D being supplanted by the Hs 130E.

HENSCHEL HS 130E

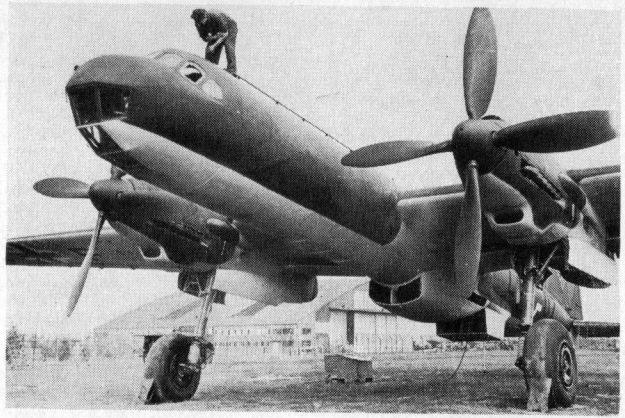
During the course of attempts to produce effective supercharged engines for flight at extreme altitudes, a scheme was proposed known as the *Höhen-Zentrale* or *HZ-Anlage*, this comprising two normal Daimler-Benz 12-cylinder liquid-cooled engines for propulsion and these being supplied with supercharged air by a third engine located in the fuselage amidships and driving an enormous blower. Such was the promise of this scheme that, in 1941, the Henschel team was ordered to redesign the Hs 130A to take the *HZ-Anlage*, this development receiving the designation Hs 130E.

The *HZ-Anlage*, which was also installed in the Dornier Do 217P, comprised two Daimler-Benz DB 603B engines driving four-blade constant-speed airscrews and super-



HENSCHEL HS 130C V3 SPECIFICATION

Type: *Four-seat High-Altitude Medium Bomber.* **Power Plants:** *Two Daimler-Benz DB 603A 12-cylinder liquid-cooled engines each rated at* 1,750 *h.p. for take-off and* 1,850 *h.p. at* 6,900 *ft.* **Armament:** (*Defensive*) *Two* 13-*mm. MG* 131 *machine guns with* 250 *r.p.g. in each of two remotely-controlled barbettes* (*dorsal and ventral*), *and one* 7.9-*mm. MG* 15 *machine gun with* 500 *rounds in extreme tail.* (*Offensive*) *Maximum bomb load of* 8,818 *lb.* **Performance:** *Maximum speed,* 277 *m.p.h. at* 16,750 *ft.; range with maximum bomb load,* 1,430 *mls., with* 4,410-*lb. bomb load and two* 198 *Imp. gal. drop tanks,* 2,070 *mls.; service ceiling* (*at* 39,600 *lb.*), 26,000 *ft.* **Weights:** *Normal loaded,* 39,600 *lb.; maximum loaded,* 44,000 *lb.* **Dimensions:** *Span,* 81 *ft.* 0½ *in.; length,* 60 *ft.* 11 *in.; wing area,* 807.292 *sq. ft.*

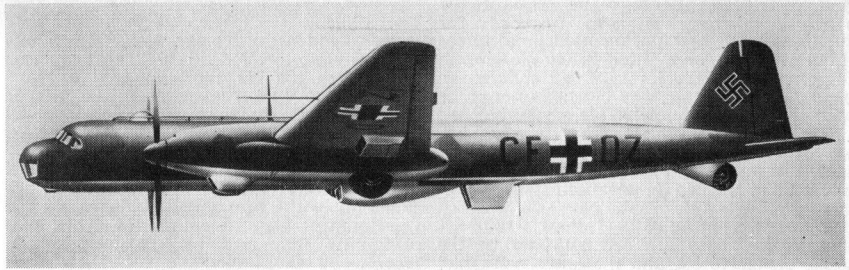


The Hs 130E-0 was essentially a redesign of the Hs 130A to utilize the so-called HZ-Anlage engine arrangement.

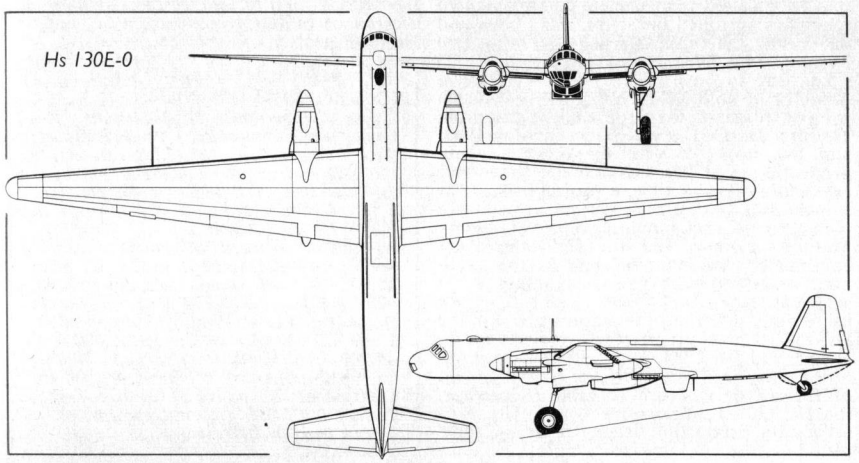
charged by a DB 605T engine mounted in the centre fuselage approximately over the wing trailing edge. Radiators for the propulsion engines were mounted beneath the wings, outboard of the nacelles, the airscoops for the blower engine were located below the fuselage, and the supercharger intercoolers were positioned beneath the wings, inboard of the engine nacelles. The *HZ-Anlage* offered a total of 3,500 h.p. for take-off, 3,720 h.p. at 6,900 ft., and 3,240 h.p. at 18,700 ft. For climb and combat a total of 2,880 h.p. was available at 45,000 ft., and maximum cruising power at the same altitude was 2,640 h.p., and the installation weight was 6,300 lb.

The initial project study, the P 80, envisaged a wing span of 91 ft. 10⅛ in. and an overall length of 55 ft. 9¼ in., the pressure cabin and basic airframe design being essentially similar to those of the Hs 130A, but at an early design stage the fuselage was elongated by 16 ft. 4¾ in., and the wing was adapted from that of the parallel Hs 130C bomber design, the outer panels being greatly extended to give an overall span of 108 ft. 3½ in. The undercarriage was also similar to that of the Hs 130C, the main members retracting aft into the engine nacelles. The pressure cabin accommodated three crew members, and fuel was distributed between a 374 Imp. gal. tank in the fuselage aft of the pressure cabin, a 185.5 Imp. gal. tank forward of the main spar and inboard of each engine nacelle, and an 84.5 Imp. gal. tank outboard of each engine nacelle, providing a total fuel capacity of 914 Imp. gal. which could be augmented by two 198 Imp. gal. drop tanks outboard of the engines. A trio of remotely-controlled cameras was installed in a bay between the pressure cabin and fuselage fuel tank.

The first prototype, the **Hs 130E V1**, was scheduled to fly in April 1942, but numerous technical problems delayed the initiation of flight testing until September 1942, and the first six flights were made without the *Höhen-Zentrale* installation. The **Hs 130E V2** joined the test programme in November 1942, the



(*Above*) *An artist's impression of the Hs 130E-0 pre-production high-altitude reconnaissance aircraft, the first of seven examples of which was flown in May 1943.*



first two flights being made without the *Höhen-Zentrale* which was installed for subsequent flights during which altitudes up to 41,000 ft. were attained. On the seventh flight, however, the Hs 130E V2 suffered an engine fire in the air, and crashed after being abandoned by its crew. This was succeeded in the test programme by the **Hs 130E V3**, and by the beginning of 1943, a pre-production batch of seven **Hs 130E-0** reconnaissance aircraft had reached an advanced stage of construction.

During the spring of 1943, the Hs 130E V1 and V2 regularly attained altitudes of the order of 47,570 ft., and the latter, with fuel tanks almost empty, actually reached 49,200 ft., these results encouraging the RLM to place an order for 100 **Hs 130E-1**s which were to carry a defensive armament comprising two remotely-controlled barbettes, one above and one below the fuselage, each mounting two 7.9-mm. MG 17 machine guns with 1,000 r.p.g., and to have provision for carrying a bomb of up to 3,968-lb. weight beneath each wing in place of the drop tank installation. The first Hs 130E-0 was flown in May 1943, and this, together with the other six pre-production machines, was intended for service evaluation. At this time, a project existed for a high-altitude destroyer variant armed with twin barbettes each mounting a pair of 20-mm. MG 151 cannon, but the *HZ-Anlage* was continuously troublesome, and as the likelihood of developing this installation to a sufficient stage of reliability to permit service use diminished, the production order for the Hs 130E-1 was progressively reduced until, at the end of 1943, only 30 remained on order, and, in 1944, with the abandonment of further development of the *HZ-Anlage*, the Hs 130E-1 programme was finally cancelled, on production examples being completed.

HENSCHEL HS 130F

The difficulties experienced with the *HZ-Anlage*, not least of which was its tremendous fuel consumption, led, in 1943, to proposals to produce the **Hs 130F** powered by four BMW 801TJ turbo-supercharged 14-cylinder radial air-cooled engines each rated at 1,800 h.p. for take-off and 1,500 h.p. at 40,000 ft. The airframe of the Hs 130F was essentially similar to that of the Hs 130E, apart from wing structural changes to permit the installation of the four radial engines, and the Development Department of the RLM was sufficiently impressed by the proposal to recommend the immediate construction of this promising aircraft. However, increasing shortages of strategic materials coupled with the early development stage then reached by the BMW 801TJ motivated against the acceptance of this recommendation, and the Hs 130F project was shelved.

HENSCHEL HS 130E-0 SPECIFICATION

Type: *Three-seat High-Altitude Reconnaissance Aircraft.* **Power Plants:** *Two Daimler-Benz DB 603B 12-cylinder liquid-cooled engines (supercharged by a Daimler-Benz DB 605T) each rated at 1,750 h.p. for take-off, 1,860 h.p. at 6,900 ft., and 1,440 h.p. at 45,000 ft.* **Armament:** *None.* **Performance:** *Maximum speed (at 31,400 lb.), 379 m.p.h. at 45,900 ft.; maximum cruising speed, 320 m.p.h. at 39,370 ft.; maximum range (with two 198 Imp. gal. drop tanks), 1,860 mls.; service ceiling (at 31,400 lb.), 49,500 ft.* **Weights:** *Normal loaded, 36,700 lb.; maximum loaded, 39,900 lb.* **Dimensions:** *Span, 108 ft. 3¼ in.; length, 72 ft. 2 in.; height (to airscrew tip), 18 ft. 4½ in.; wing area, 914 sq. ft.*

HENSCHEL HS 132

At a relatively early stage of dive-bomber development in Germany careful study was given to methods of enabling the pilot to withstand high *g* values during the pull-out from a dive without blacking-out. It was ascertained that the average pilot in an ordinary sitting posture usually blacked-out at between 4 and 5*g* but that if the pilot lay prone the onset of black-out could be delayed to as much as 10 or 11*g*. To ascertain the practicability of the prone position for dive-bomber pilots, the *Deutsches Versuchsanstalt für Luftfahrt* (DVL) began an investigation for which, in 1937, the *Flugtechnische Fachgruppe* of the *Technische Hochschule* Berlin-Charlottenburg produced a small prone-pilot research aircraft, the Berlin B 9.

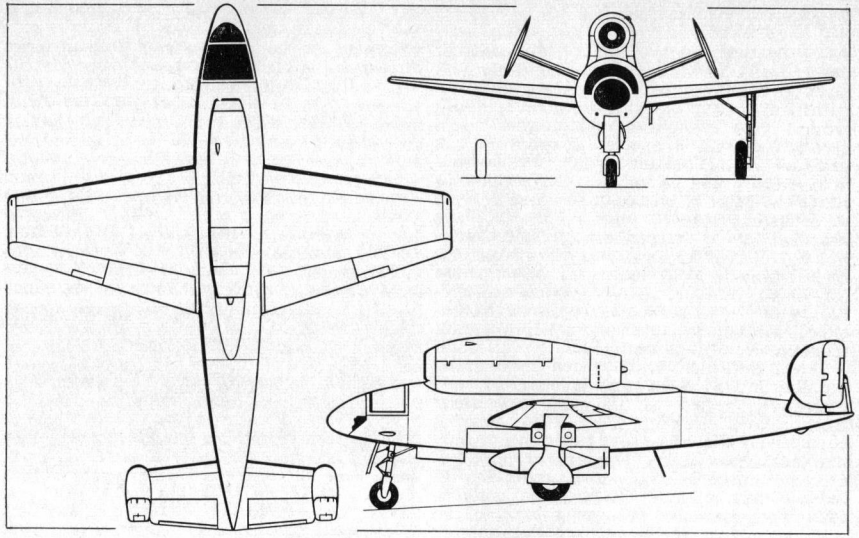
The B 9, which was powered by two 105 h.p. Hirth HM 500 air-cooled engines, was extensively tested at the *Erprobungsstelle* Rechlin and elsewhere until 1944, proving conclusively that the prone position not only markedly reduced *g* effects on the pilot but also permitted a substantial reduction in fuselage frontal area. Thus, when early in 1944 the Henschel Flugzeugwerke began work on a fast, turbojet-driven dive-bomber and ground attack aircraft, the design team utilized data provided by trials with the B 9 and adopted a prone position for the pilot.

The Henschel design, the Hs 132, placed accent on simplicity and ease of manufacture. The wing was a two-spar wooden structure with plywood skinning and the fuselage was a circular metal monocoque. The single turbojet was mounted above the fuselage and exhausted over the rear fuselage and between the twin vertical surfaces of the tail assembly. With the acceptance of the design study by the *Technische Amt* of the RLM in May 1944, a series of six prototypes was ordered of which two were to be A-series and four B-series aircraft. The **Hs 132A**, for which the **Hs 132 V1** and **V2** were intended to serve as prototypes, was a dive-bomber powered by a single BMW 003A-1 turbojet and having provision for a single 1,102-lb. SC or SD 500 bomb semi-recessed beneath the fuselage, whereas the **Hs 132B** was to be a ground attack aircraft powered by a single Jumo 004B-2, carrying a similar bomb load and having a built-in armament of two 20-mm. MG 151 cannon with 250 r.p.g. Both versions were stressed to withstand 12*g*, and it was believed that in a diving attack, during which

HENSCHEL HS 132A SPECIFICATION

(Performance Data is based on Manufacturer's Estimates)

Type: *Single-seat Dive-Bomber.* **Power Plant:** *One BMW 003A-1 Sturm axial-flow turbojet rated at 1,760 lb.s.t.* **Armament:** *One 1,102-lb. SC 500 or SD 500 bomb.* **Performance:** *Maximum speed (without bomb), 485 m.p.h. at 19,685 ft., (with bomb) 435 m.p.h.; range at 13,125 ft., 485 mls., at 32,810 ft., 696 mls.; service ceiling, 34,450 ft.* **Weights:** *Loaded, 7,496 lb.* **Dimensions:** *Span, 23 ft. 7 in.; length, 29 ft. 2⅓ in.; wing area, 159.3 sq. ft.*



speeds in excess of 500 m.p.h. would be attained, Allied anti-aircraft gunners, who had taken the measure of orthodox dive-bombers, would be unable to track so small and fast moving a target.

It was proposed that with the availability of the Heinkel-Hirth 011A-1 turbojet of 2,866 lb.s.t. production would commence of the **Hs 132C** which was to have an armament of two 30-mm. MK 103 cannon with 60 r.p.g., two 20-mm. MG 151 cannon with 250 r.p.g., plus either a 551-lb. or 1,102-lb. bomb, or, with the 30-mm. weapons deleted, a single 2,205-lb. SD 1000 bomb. Yet a further projected development was the **Hs 132D** on which the wing span and area were to be increased from 23 ft. 7 in. to 29 ft. 10¼ in. and from 159.3 to 172.223 sq. ft. respectively.

By the spring of 1945, prototype construction was well advanced and the Hs 132 V1 was being readied for initial flight trials, the V2 and V3 were 80 and 75 per cent complete respectively, and the remaining three prototypes were in final assembly, but before trials could begin the factory was overrun by Soviet forces.

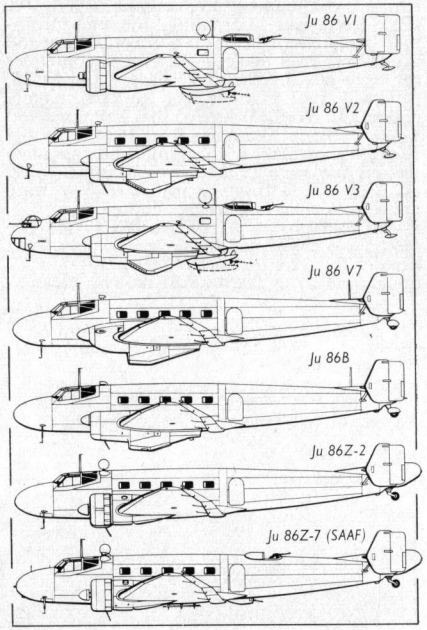
JUNKERS JU 86

GERMANY

The history of aviation has frequently witnessed the appearance of bombers derived from transports and transports from bombers, but rarely has an aircraft been designed from the outset to fulfil the roles of both bomber and *commercial* transport without fundamental structural changes between the two versions. Such, however, was the basic concept from which stemmed what were later to be considered the first modern bombers to attain service with the *Luftwaffe*, the Junkers Ju 86 and the Heinkel He 111.

With the creation of the Third Reich in 1933, elaborate measures had been taken to conceal the extent of rearmament that was taking place on the foundations already established by the *Reichswehr*. The appearance in the mid 'thirties of what were presented as high-speed commercial transports but which were subsequently claimed to be, in reality, the prototypes of bombers, with but few concessions to their ostensibly more pacific role to gain their acceptance by a gullible aeronautical community, has often been instanced as a glaring example of this German duplicity and subterfuge. In fact, these transports were *not* the progenitors of future bombers; their basic designs had been conceived to fulfil *both* civil and military tasks, and commercial transport and bomber versions had been evolved in parallel.

Both the Ju 86 and the contemporary He 111 had been designed to a specification framed by the Technical Department of the embryo *Reichsluftfahrtministerium* (RLM) and Deutsche Lufthansa (DLH), Germany's national airline, in close collaboration. A high-speed twin-engined aircraft embodying state-of-the-art structural and aerodynamic techniques was required by the RLM for use as a medium bomber by the still-clandestine *Luftwaffe*, and by DLH as a 10-passenger prestige-building airliner. The differing demands of the two roles were by no means incompatible at this time, as, from the DLH viewpoint, operating economics were a secondary consideration, although emphasis on military potential in the



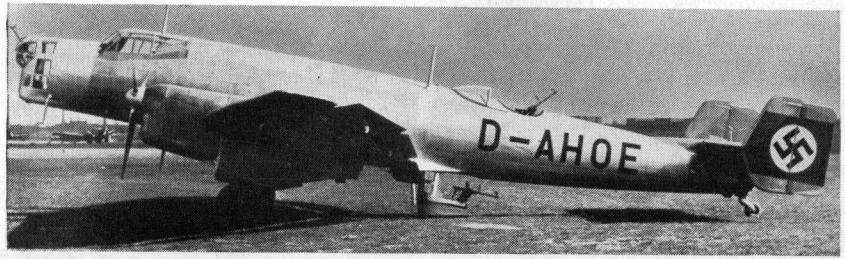
design was to result in airliners of somewhat dubious commercial value. Nevertheless, they were destined to play major roles in gaining international prestige for Germany's fledgeling aircraft industry.

The basic specification for this dual-role aircraft was issued to Junkers and Heinkel early in 1934, five prototypes being ordered from each manufacturer during the early spring, with bomber and commercial transport prototypes alternating, the first prototype being completed as a bomber, the second as a transport, and so on. Junkers' contender for both civil and military orders, the Ju 86, followed the example set by the single-engined Ju 60 *Pfeil* (Arrow) that had appeared a year earlier in departing from the traditional Junkers corrugated skinning and angular-section fuselage with multi-spar wing structure, an oval-section fuselage with two-spar wing and smooth skinning being adopted.

The first prototype, the **Ju 86a** (*Werk-Nr.* 4901), was completed in the remarkably short time of five months, occupying 271,091 man-hours, and flying for the first time on November 4, 1934 at Dessau, four months before its Heinkel competitor, the He 111a, was to fly a Marienehe. The aircraft had been designed from the outset to be powered by the new compression-ignition Jumo 205 engine which had been developed by the Junkers-Motorenbau and was about to enter production at Köthen. This six-cylinder two-stroke water-cooled Diesel did not offer a particularly favourable power-to-weight ratio, but its fuel consumption was markedly superior to contemporary petrol engines offering a similar output, and it possessed a small frontal area. As no flight-cleared Jumo 205 was available for installation in the Ju 86a, this first prototype was completed with two Siemens SAM 22 nine-cylinder radial air-cooled engines driving fixed-pitch two-bladed wooden airscrews.

Flown initially without defensive gun positions, the Ju 86a revealed a number of shortcomings during the initial flight test phase, the most serious of these being exceptionally poor control response. Directional stability was inadequate, and the aircraft was returned to the experimental hangar for modifications. Simultaneously, dorsal and ventral gun positions were introduced, the upper position being semi-enclosed by means of a transparent canopy and the lower position comprising a semi-retractable "dustbin". Similar provision was made on the third prototype, the **Ju 86 V3**, which also featured glazed panels in the extreme nose for the bombardier, and a small, manually-operated nose turret. The Ju 86 V3 (D-ALAL *Werk-Nr.* 4903) was, in fact, the second prototype to fly, commencing its test programme at Dessau in January 1935, initially with SAM 22 radials driving three-blade variable-pitch Hamilton airscrews and, from March, with Jumo 205C diesel engines. In the meantime, the second prototype, the **Ju 86b** (subsequently redesignated **Ju 86 V2**), had been completed with Jumo 205C engines from the outset, this aircraft (D-ABUK *Werk-Nr.* 4902) joining the test programme in April 1935.

The Ju 86 V5 (Werk-Nr. 4905), the third bomber prototype of the basic design, flown in August 1935 as the production prototype for the Ju 86A.



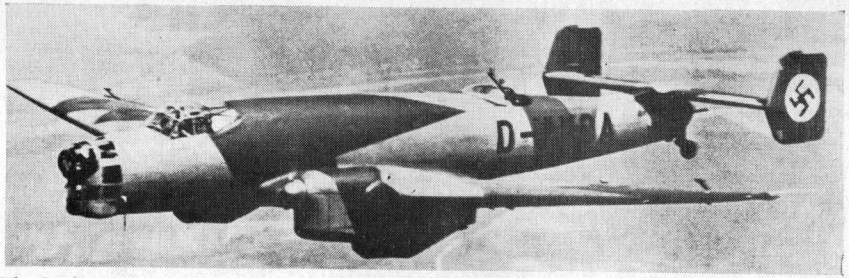
The Ju 86 V2 was the first prototype for the commercial transport version, and differed from the bomber prototypes solely in having the defensive gun positions and the vertical bomb cells (first installed in the Ju 86 V3) deleted, and accommodation provided for 10 passengers in individual staggered seats each with its own window in a somewhat confined cabin which possessed a width of only 4 ft. 9 in. The second transport prototype, the **Ju 86 V4** (D-AREV *Werk-Nr.* 4904), was intended as the production prototype for the Ju 86B commercial passenger aircraft, and flown in May 1935, it was delivered to DLH during the summer for evaluation and route-proving trials, initially being named *Dresden* but subsequently renamed *Brocken* when it was decided that all DLH aircraft of this type should be named after mountains. It was later joined by the Ju 86 V2, but both had been returned to Dessau as development aircraft by the end of December.

By this time, it had become patently obvious that certain aspects of the Ju 86's handling characteristics still left much to be desired, and the Junkers team was already engaged in redesigning the wing to reduce aspect ratio and provide an increased gross area. In its original form, the wing featured unbroken taper from root to tip on both leading and trailing edges. Trailing-edge taper was now reduced, the original taper being retained from a point at approximately two-thirds span, this effectively increasing the chord over two-thirds of the wing. Simultaneously, the taper on the leading-edge of the outer third was marginally increased, and thus the Ju 86 was provided with a distinctive wing planform featuring broken taper on both leading and trailing edges. Both the Ju 86 V4 and **Ju 86 V5** (D-AHOE *Werk-Nr.* 4905) were fitted with the modified wing, the latter, which was considered as the production prototype for the Ju 86A bomber, having flown in August 1935. At the same time, the tailskid was supplanted by a tailwheel and the radiator slung beneath the rear portion of the engine nacelle was redesigned to improve cooling.

JUNKERS JU 86A

Production of both the Ju 86A bomber and Ju 86B commercial transport had begun simultaneously at Dessau late in 1935, the pre-production batch comprising 13 **Ju 86A-0** bombers (*Werk-Nummern* 0001-6, 0013–5 and 0017–20) and seven **Ju 86B-0** transports. These began to leave the assembly line in February 1936, the Ju 86A-0s being promptly delivered to the *Luftwaffe* for evaluation, followed in the late spring by the first production **Ju 86A-1** bombers which were issued to *Kampfgeschwader* 152 (later redesignated KG 1) "Hindenburg".

Essentially similar to the Ju 86 V5, which, apart from the modified wing, redesigned radiators and tailwheel, had introduced a



The first bomber production version of the Ju 86, the Ju 86A-1, delivered to Kampfgeschwader 152 'Hindenburg' in 1936.

redesigned and more extensively glazed nose and a new semi-retractable ventral gun position, the Ju 86A-1 was powered by two Jumo 205C-4s each rated at 600 h.p. for take-off and offering a maximum continuous output of 510 h.p. The fuselage structure comprised four longerons of open section connected by oval frames and covered by flush-riveted stressed skin, and the wing was built up on two main spars and an auxiliary spar of Warren-girder type with smooth skinning reinforced internally by profile stiffeners. The Junkers "double-wing" flaps were divided into three sections which occupied the entire trailing edge, the outer section serving as an aileron. One of the striking features of the design was the extremely narrow track offered by the main undercarriage members which were retracted laterally into wing wells by means of an electric motor.

Carrying a crew of four comprising pilot, navigator, radio operator-bombardier and gunner, the Ju 86A-1 had a defensive armament of three 7.9-mm. MG 15 machine guns distributed between the spherical mounting in the nose, a dorsal position which could be partly enclosed by a sliding canopy, and a semi-retractable rotating ventral "dustbin". Provision was made in the fuselage for the stowage of eight 220-lb. SC 100 bombs suspended vertically in individual cells, and standard fuel comprised 132 Imp. gal. distributed between tanks immediately outboard of the engine nacelles. For extended-range missions auxiliary tanks could be installed inboard of the nacelles.

JUNKERS JU 86B

Included in the initial Ju 86 pre-production batch were, as previously stated, seven transports (*Werk-Nummern* 0007–12 and 0016) designated as Ju 86B-0s, the last of these (*Werk-Nr.* 0016) subsequently having its Jumo 205C diesels replaced by BMW 132Dc radials with which it received the export designation **Ju 86Z-2**, although it was destined to serve with DLH as D-ANUV *Wasserkuppe*. The first pre-production Ju 86B-0 (D-AXEQ *Bückeberg*) was retained by Junkers, this aircraft subsequently flying from Dessau to Bathurst on August 22–23, 1936, covering the distance of 3,603 miles in an elapsed time of 20 hours. The second Ju 86B-0 was delivered to Swissair in April 1936, and, registered HB-IXI, was operated over the Zürich-Frankfurt-am-Main route as a nocturnal mailplane.

The remaining four Ju 86B-0s were delivered to DLH as D-AHYP *Schneekoppe* (*Werk-Nr.* 0009), D-ALOZ *Zugspitze* (*Werk-Nr.* 0010), D-AQER *Inselberg* (*Werk-Nr.* 0011), and D-AZAH *Feldberg* (*Werk-Nr.* 0012). Similar to the Ju 86 V4, the Ju 86B-0s were introduced on DLH's routes from Berlin to Bremen, Cologne, Breslau, Dortmund, Gleiwitz, Hanover and Leipzig by the end of 1936.

JUNKERS JU 86C

During the course of 1937, the four Ju 86B-0s were joined on the DLH routes by six **Ju 86C-1s**. Like their predecessors, these were powered by Jumo 205C diesels, and differed only insofar as they adopted the fuselage tail extension standardised for the Ju 86D-1 bomber. The six Ju 86C-1s delivered to DLH were: D-AKOI *Kaiserstuhl* (*Werk-Nr.* 0972), D-AQEA *Schauinsland* (*Werk-Nr.* 0973), D-ASOE *Hesselberg* (*Werk-Nr.* 0974), D-AVOE *Obersalzberg* (*Werk-Nr.* 0975), D-AMYO *Melibokus* (*Werk-Nr.* 0976), and D-AJUU *Vogelsberg*. Eventually operating over 18 routes, these remained in DLH service until disposed of in 1940.

JUNKERS JU 86D

With the arrival of the Ju 86A-1 in *Luftwaffe* service in the early summer of 1936, it was found that longitudinal stability was still inadequate, and an effective remedy was provided by a wedge-shaped extension replacing the tail cone and projecting aft of the tail assembly. This was first tested on a pre-production Ju 86A-0 which was redesignated **Ju 86 V6**. This aircraft also embodied an increase in standard fuel tankage to a total of 198 Imp. gal. at the request of the RLM, and both modifications were introduced on the Dessau assembly line. With these changes the production bomber was redesignated **Ju 86D-1**, and only a score or so of Ju 86A-1s had left the assembly line when the initial model was supplanted by the later sub-type, both variants being seen side by side at Bückeberg in October 1936 when the bomber was demonstrated publicly for the first time.

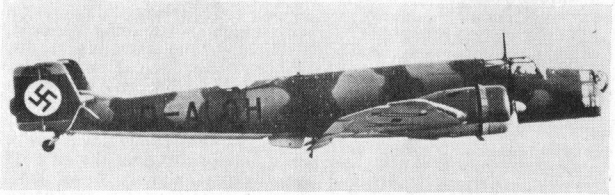
Late in 1937, five Ju 86D-1 bombers were despatched to Spain for experimental operation by the Condor Legion's bombing element, *Kampfgruppe* 88, and later saw appreciable action, particularly over the Extremadura sector, but the *Luftwaffe* had become somewhat disenchanted with the Junkers bomber some time before its appearance in Spanish skies. By the beginning of 1937, the He 111B was manifesting a marked superiority over the Ju 86D in virtually every respect, and the Jumo 205C diesel engines of the latter were not fulfilling their earlier promise. The diesel had proved itself a perfectly reliable power plant provided that r.p.m. was maintained for long periods at a constant level, but it did not take kindly to the frequent changes of r.p.m. demanded by combat manoeuvres. A puzzling characteristic was an unaccountable power drop at altitudes above 16,500 ft., a shortcoming which was not to be rectified until prolonged testing had been undertaken at Rechlin, and it was evident that the Jumo 205 was unsuited as a bomber power plant despite its exceptional operating economy.

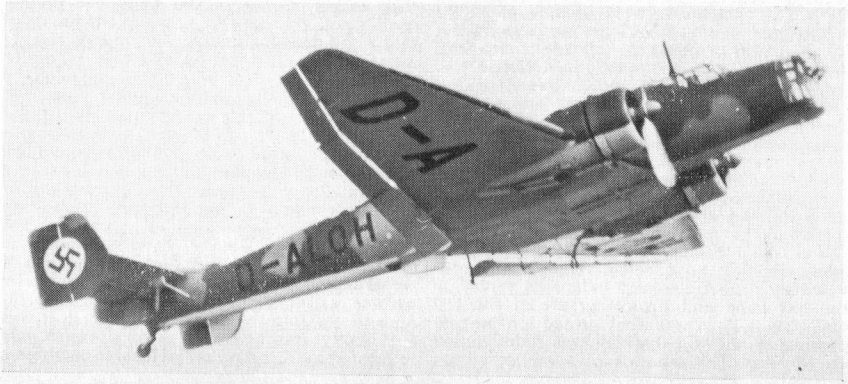
Junkers had already experienced some doubts concerning the wisdom of its choice of diesel engines; doubts engendered primarily by commercial factors. Although the performance of the Ju 86 was not phenomenal, it was sufficiently impressive to arouse immediate interest abroad, but potential foreign customers

were disinclined to consider the diesel engines which could not compete on the score of power-to-weight ratio with contemporary petrol engines. Furthermore, the diesel demanded exceptionally careful maintenance by specially trained personnel. Thus, shortly after the delivery of the first Ju 86A-0 bombers, Junkers had begun to consider alternative power plants in order to make the Ju 86 a more attractive export proposition.

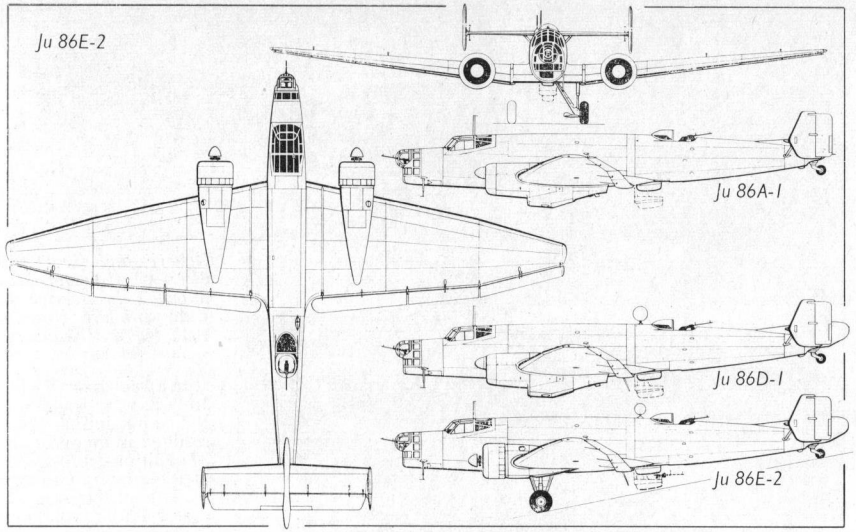
EXPORT MODELS

The first foreign government to evince serious interest in the Ju 86 was that of Sweden which, after discussions with Junkers on alternative power plants to the Jumo 205C, placed an order on June 30, 1936 for one Ju 86A-1 airframe powered by Pratt & Whitney Hornet S1E-G nine-cylinder radial air-cooled engines rated at 875 h.p. for take-off and possessing a maximum continuous rating of 800 h.p. This aircraft, which was designated by Junkers as the **Ju 86A-1k**, was delivered to Sweden in December 1936, but in the previous month the



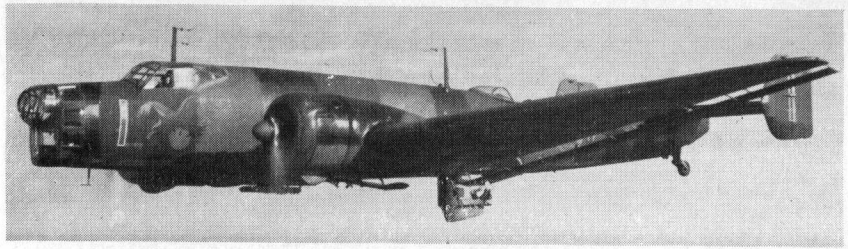


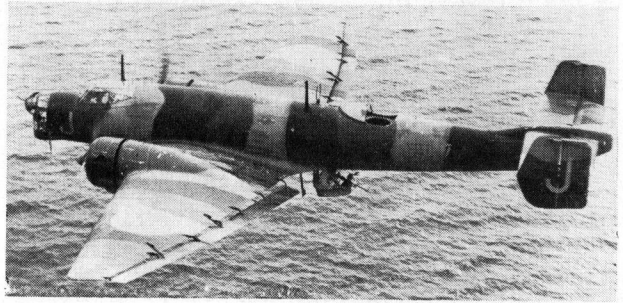
(Left and below) An early production Ju 86E-0 under test prior to delivery to the Luftwaffe.



JUNKERS JU 86D-1 SPECIFICATION

Type: *Four-seat Medium Bomber.* **Power Plants:** *Two Junkers Jumo* 205C-4 *six-cylinder vertical opposed-piston compression-ignition two-stroke engines each rated at* 600 *h.p. for take-off.* **Armament:** (*Defensive*) *One hand-operated* 7.9-*mm. MG* 15 *machine gun on spherical nose mounting, one* 7.9-*mm. MG* 15 *on flexible mounting in dorsal position, and one* 7.9-*mm. MG* 15 *in rotatable semi-retractable ventral turret.* (*Offensive*) *Eight* 220-*lb. SC* 100 *or* 16 110-*lb. SC* 50 *bombs stowed internally in vertical cells.* **Performance:** *Maximum speed,* 186 *m.p.h. at sea level,* 202 *m.p.h. at* 9,840 *ft.; cruising speed,* 171 *m.p.h. at* 3,280 *ft.,* 177 *m.p.h. at* 11,480 *ft.; tactical radius with maximum bomb load,* 354 *mls. at* 177 *m.p.h.; maximum range,* 932 *mls.,* (*with auxiliary fuel tanks*), 1,240 *mls.; service ceiling,* 19,360 *ft.* **Weights:** *Empty,* 11,354 *lb.; empty equipped,* 11,795 *lb.; normal loaded,* 17,770 *lb.; maximum loaded,* 18,078 *lb.* *Dimensions:* *Span,* 73 *ft.* 9¾ *in.; length,* 58 *ft.* 7½ *in.; height,* 16 *ft.* 7¼ *in.; wing area,* 882.64 *sq. ft.*





(*Above and Left*) *Ju 86K (T 3) torpedo-bombers in service in 1944 with the Swedish F 17 based at Ronneby.*

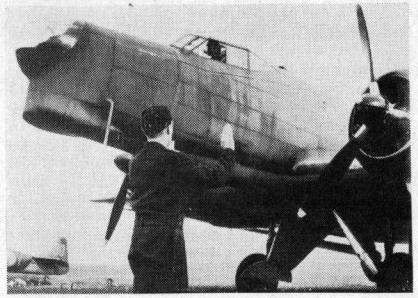
Swedish government had placed an order for two further Hornet-powered machines, and as other foreign contracts were now imminent for both military and commercial versions of the Ju 86, Junkers applied the suffix letter 'K' indicating *Krieg* (War) to all export bomber-models, and the letter 'Z' indicating *Zivil* (Civil) to all export commercial transport variants. Thus, the trio of Hornet-powered Swedish aircraft became **Ju 86K-1s**, one of these later being fitted with skis for winter trials in Sweden as the sole example of the **Ju 86K-2**.

In Swedish service the Ju 86K was designated B 3, and initial trials resulted in an order for 37 additional aircraft, 20 of these being powered by Bristol Pegasus III nine-cylinder radial air-cooled engines, licence manufacture of which had been initiated in Sweden in 1937 by the Nohab Flygmotorfabriker as the My III rated at 820 h.p., and the remaining 17 with Nohab-built Pegasus XII (My XII) engines rated at 920 h.p. With the Pegasus III engines the bomber was designated **Ju 86K-4** by Junkers and B 3A by the Swedish Air Force, the designations for the Pegasus XII-powered version being **Ju 86K-5** and B 3B respectively.

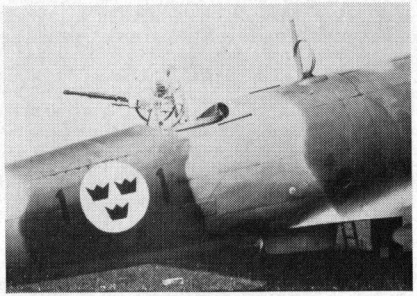
The order provided for the bulk of the bombers to be assembled in Sweden under the supervision of Junkers technicians at the Trollhättan factory of the newly-established Svenska Aeroplan Aktiebolaget (SAAB) and actual licence manufacture was commenced in 1938 when 40 aircraft were ordered from SAAB. In the event, this order was to be cut back to only 16 aircraft, the Swedish licence-built aircraft being designated **Ju 86K-13** by Junkers and B 3C and B 3D by the Swedish Air Force, the former having Nohab-built Pegasus XXIV (My XXIV) engines rated at 980 h.p., and the latter having imported PZL-built Pegasus XIX engines rated at 835 h.p. The first SAAB-built Ju 86K-13 was flown in August 1939 and the 16th and last in January 1941. Subsequently, 15 of the Ju 86K-4s (B 3As) had their Pegasus IIIs replaced by Pegasus XXIVs with which they became B 3C-2s.

The Ju 86K was destined to enjoy a long career with the Swedish Air Force, entering service in the medium bomber role in 1937 with the F 1 wing at Västerås and, between 1944 and 1948, as a torpedo-bomber under the designation T 3 with the F 17 at Ronneby. One or two were converted as night fighter trainers, these being equipped with the radar installed in the Mosquito N.F.Mk.19, and in 1948, the surviving examples of the Ju 86K were converted as 12-passenger transports, the last being withdrawn from service in this role in 1956.

During the course of 1937, small orders were received from both the Portuguese and Chilean governments for batches of Pratt & Whitney Hornet-powered bombers, these, delivered in 1938, receiving the export designation **Ju 86K-6**, but Junkers' best customer for the bomber, apart from the Swedish government, was the Hungarian government which had established an air arm in defiance of the Versailles Treaty, and which, in 1937, placed an order for 24 **Ju 86K-9s** powered by the Gnôme-Rhône 14K Mistral-Major 14-cylinder air-cooled radial rated at 870 h.p. and manufactured under licence by the Manfred Weiss Flugzeug und Motorenfabrik at Budapest. These equipped the two squadrons of the 3rd Bomber Regiment formed in 1939, subsequently becoming the 3/I and 3/II Bomber Groups. When Hungary initiated



(*Above*) *A Swedish Ju 86K-4 (B 3C-2) with night fighter radar, and (below) with an experimental dorsal turret.*

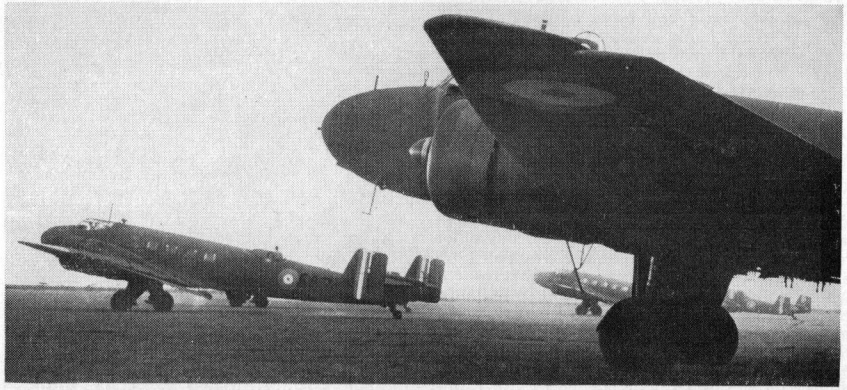


hostilities against the Soviet Union, the Ju 86K-9s were equipping the 4/IV Bomber Group based at Debrecen which flew operational sorties against Soviet targets until late 1941, and part of the 1st Independent Long-Range Reconnaissance Group based at Budaörs. When the last-mentioned Group transferred to Russia in June 1942, having in the meantime been partly re-equipped with the He 111P-6, two Ju 86K-9s remained on the operational strength, and the Junkers bomber still equipped a Hungarian high-altitude reconnaissance flight as late as mid-1944.

The export of commercial transport versions of the Ju 86, while not achieving the quantitive success of the bomber, may be considered by the standards of the day to have flourished. The first export sale was the purchase of the second Ju 86B-0 by Swissair, which, in February 1937, took delivery of a second aircraft, a **Ju 86Z-1** (this being the export designation of the Jumo 205C-powered Ju 86C-1), which was registered as HB-IXE. Two years later, after suffering damage in a crash landing, this aircraft was to be returned to Dessau where, during the course of reconstruction, the original Jumo 205Cs were replaced by BMW 132Dc radials, and the aircraft returned to Swissair in the spring of 1939 as a **Ju 86Z-2** and re-registered HB-IXA.

In 1938, LAN-Chile purchased three Jumo-powered Ju 86Z-1 transports, an example of this type having been operated briefly during the previous year by Southern Airlines and Freighters in Australia, but returned to Junkers in August 1937. Lloyd Aéreo Boliviano received two **Ju 86Z-7s** powered by Pratt & Whitney Hornet S1E-G radials, these being

Ju 86Z-7s of the S.A.A.F. taking-off in 1940 on an anti-submarine patrol.



taken over by the Bolivian Air Force in May 1941, and one Ju 86Z-7 was delivered to the Swedish AB Aerotransport in March 1938 as SE-BAE *Svalan*, this operating over the Stockholm-Malmö-Hanover night mail route until disposed of in 1940 to the Swedish Air Force which operated it as the Tp 9 until 1958.

Five Ju 86Z-2 transports powered by BMW 132Dc radials were sold in 1938 to Manchurian Air Lines for operation over the Dairen-Mukden-Hsinking-Harbin-Chiamusse route, but the most important customer for the Ju 86 transport was South African Airways (SAA) which placed an initial order in 1936. SAA elected to use the Rolls-Royce Kestrel XVI 12-cylinder liquid-cooled engine offering 745 h.p. for take-off, presumably being motivated in its choice by the fact that licence manufacture of the Kestrel-engined Hawker Hartbees had just commenced at Roberts Height, Pretoria, and overhaul facilities for the power plant had been established in South Africa. Accordingly, Junkers modified a Ju 86C-1 to take Kestrels, this combination, which was first flown in the autumn of 1936, being designated **Ju 86 V7**. The first few SAA aircraft were completed at Dessau late in 1936 with Kestrels but it was soon ascertained that these engines were not entirely suited for commercial operation, and SAA decided to acquire instead the standard Hornet-engined Ju 86Z-7, the few aircraft completed with Kestrels being re-engined.

SAA placed total orders for 18 aircraft, comprising 17 Ju 86Z-7s and, for some obscure reason, a single Ju 86K-1 bomber which it may be presumed was intended for evaluation by the South African Air Force despite its civil registration ZS-ANI and SAA fleet name *Lady Ann Barnard*. In the event, *all* the SAA aircraft were destined to fulfil the more militant role. The first Ju 86Z-7 reached South Africa in June 1937, and in 1939 all 18 aircraft were passed to the South African Air Force and modified for use as reconnaissance-bombers. Dorsal and ventral gun positions were introduced, these being generally similar to those featured by the standard bomber, a sliding canopy partly enclosing the dorsal position with its single 0.303-in. Vickers gun, the semi-retractable ventral "dustbin" mounting a similar weapon. A fixed forward-firing 0.303-in. gun was mounted in the extreme nose, this being operated by the pilot with the aid of a ring-and-bead sight provided in front of the windscreen, and bomb racks were attached beneath the fuselage centre section.

Following the outbreak of war, the S.A.A.F. began anti-submarine and coastal patrols with its converted Ju 86Z-7s from Durban, Port Elizabeth, Cape Town, and Walvis Bay. The first success of these operations was the interception of the German blockade-runner S.S. *Watussi* off the Cape Coast in December 1939. In May 1940, the Ju 86s replaced the Ansons of No. 12 Squadron at Nairobi, three flights each of four aircraft being formed and detached to Eastleigh in the Transvaal, and Dar-es-Salaam and Moshi in Tanganyika. The Eastleigh-based flight was primarily concerned with coastal patrol and shipping escort tasks, and in June the Moshi-based flight was transferred to Mombasa in Kenya for operations against the Italian forces in Ethiopia and Somalia. On June 14, 1940, in concert with the Fairey Battles of No. 11 Squadron, it performed the first S.A.A.F. operational bombing sortie.

The Ju 86s of No. 12 Squadron had moved forward to Margherita in Somalia by February 25, 1941, in the wake of the advancing South African forces that they were supporting and reached Mogadishu on March 2nd where the converted transports were supplemented by Martin Marylands. By the end of March, No. 12 Squadron was operating from Jijiga,

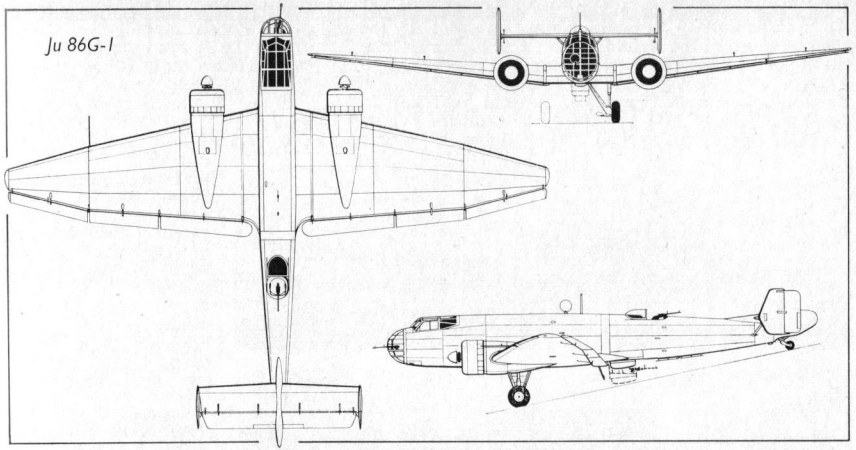
Ethiopia, and in the following month several of the Ju 86s were detached to No. 11 Squadron operating from Gumbar Dar. In May 1941, No. 12 Squadron converted completely to Marylands and was transferred to the Middle East, and at the end of the month No. 11 Squadron was disbanded. No. 16 Squadron, which had been formed at Addis Ababa on May 1st, took over the Ju 86s and continued to operate them until its disbandment during the following August. But the operational career of the now well-worn Ju 86Z-7s had not yet reached its conclusion. No. 14 Squadron had been operating a flight of Ju 86s in December 1940 from Nakura, Kenya, on reconnaissance and training tasks, but had completely converted to Marylands during the spring of 1941. However, in July 1942, No. 22 Squadron was formed at Durban from No. 31 Flight for coastal reconnaissance and anti-submarine patrols, and the surviving Ju 86Z-7s were turned over to this unit which operated them alongside Ansons until, in September, the Squadron re-equipped with Venturas.

JUNKERS JU 86E

While the Ju 86 was enjoying some successes both as a bomber and as a transport on the export market, it was not proving an unqualified success in *Luftwaffe* service, despite the publicity that it was given by the German Press. Junkers had failed to eradicate the shortcomings of the Jumo 205C as a bomber power plant, with the result that the serviceability rate in the *Kampfgruppen* operating the Ju 86D was extremely low, seized pistons and erosion of the welding of the exhaust ports being but two of the many causes of unserviceability. The expansion programme for 1937 had called for 12 Ju 86-equipped *Gruppen* of 36 aircraft, and as Junkers at Dessau could not cope with the quantity of aircraft involved, orders were placed with the Henschel Flugzeugwerke's new plant at Berlin-Schönefeld.

However, the difficulties experienced with the Jumo-engined Ju 86 in *Luftwaffe* service coupled with the superiority demonstrated by the He 111B dictated major revision of the re-equipment and expansion programme, and a drastic cut-back in orders for the Junkers bomber. In parallel with the construction of the Ju 86A-1k ordered by the Swedish government, Junkers had converted a Ju 86D-0 airframe to take a pair of similar Pratt & Whitney Hornet S1E-G radials with which it had been flown at the beginning of 1937 as the **Ju 86 V8**. This was intended primarily as a demonstration aircraft to solicit export sales, but the **Ju 86 V9**, which was a converted Ju 86D-1 airframe fitted with the German licence-built Hornet, the BMW 132F, was intended for evaluation at Rechlin. The Ju 86 V9 (D-ADAA) was tested throughout the spring of 1937, displaying a noteworthy improvement over the Jumo 205C-powered model, and Junkers was instructed to switch to the BMW 132F on the Ju 86 assembly line at the earliest stage practicable.

With the BMW 132F engine the bomber was redesignated **Ju 86E-1**, deliveries to the *Luftwaffe* commencing in the late summer of 1937. The BMW 132F offered 810 h.p. for take-off and 650 h.p. at 14,765 ft., and necessitated an increase in standard internal fuel capacity to 330 Imp. gal. Serviceability was notably improved, this being the primary purpose of the exercise, and the fact that performance was only marginally increased was considered of little importance as the Ju 86E was now intended as nothing more than an interim type to occupy the Dessau line while tooling was being prepared for the licence-manufacture of the He 111. The Ju 86E-1 shared the assembly line with the Ju 86K-4s for Sweden, the K-6s for Portugal and Chile, and the K-9s for Hungary, and after some 30



BMW 132F-powered Ju 86E-1s had been completed, the slightly more powerful BMW 132N, rated at 865 h.p. for take-off and 665 h.p. at 14,765 ft., was introduced to result in the **Ju 86E-2**.

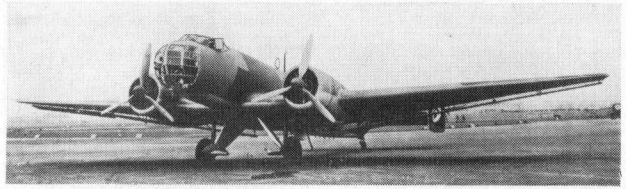
JUNKERS JU 86G

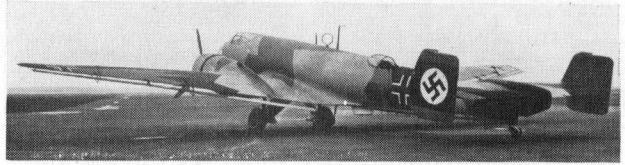
Among criticisms levelled at the Ju 86 bomber had been the poor view offered the pilot for take-off until the tail had left the ground. To rectify this Junkers moved the entire cockpit forward and introduced a redesigned, fully-glazed curved nose with a single 7.9-mm. MG 15 machine gun protruding through the starboard panelling. This redesigned forward fuselage was tested on a converted E-1 early in 1938, the test aircraft being designated **Ju 86 V10**, and this modification was introduced on the last 40 production aircraft which, apart from the new forward fuselage and improved blind-flying equipment, were identical to the Ju 86E-2. Designated **Ju 86G-1**, these aircraft came off the Dessau assembly line in the late spring and early summer of 1938 when production finally terminated, some 390 examples of this aircraft (including commercial transports) having been delivered, this total including those assembled in Sweden but excluding those manufactured under licence in that country.

By the autumn of 1938, the numbers of Ju 86s on the first-line strength of the *Luftwaffe* had attained their peak, OKL strength returns for September 19, 1938 listing 235 Ju 86s of all types in service with the *Kampfgruppen* of which 200 were serviceable, the

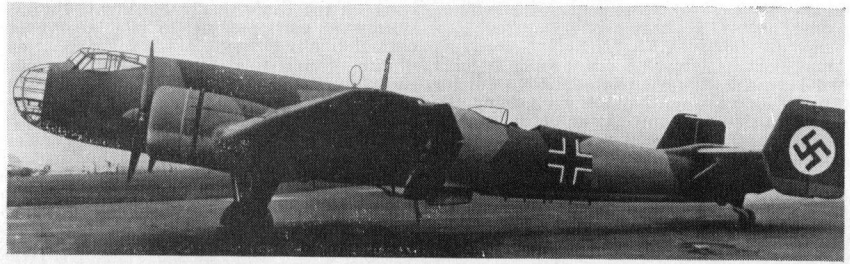
total figure comprising 159 Ju 86As and Ds, 43 Ju 86Es and 33 Ju 86Gs. From this point the phase-out of the Ju 86 from the *Luftwaffe*'s first-line elements began, its tempo increasing sharply from the beginning of 1939, and when hostilities began in September of that year only one *Gruppe* still possessed the Junkers bomber, this being IV/KG 1 with some 30 Ju 86G-1s, and this, too, had been deactivated by the end of the Polish campaign.

The majority of the Ju 86s were relegated to the *Kampffliegerschulen* and other training establishments during the course of 1939, but late in 1942, Ju 86s were withdrawn from the schools to equip two emergency transport *Gruppen*, K.Gr.z.b.V.21 and 22, which were hurriedly formed to participate in the aerial supply lift into Stalingrad, these being activated at the beginning of December with a total of 58 aircraft. Operating into Tazinskaya in appalling weather, the ageing bombers were found to be totally unsuited for the task, and





(*Left and below*) *A standard Ju 86G-1 with forward-positioned cockpit and redesigned nose which entered service in the summer of* 1938.



JUNKERS JU 86G-1 SPECIFICATION

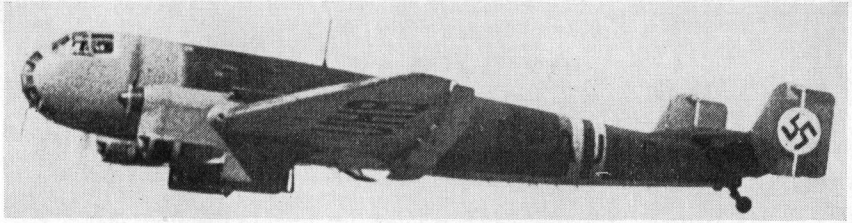
(Data in parentheses relates specifically to Ju 86E-1. Data for Ju 86E-2 is similar to that quoted for the Ju 86G-1 apart from overall length which is similar to that of Ju 86E-1) **Type:** *Four-seat Medium Bomber.* **Power Plants:** *Two BMW* 132*N* (132*F*) *nine-cylinder radial air-cooled engines each rated at* 865 (810) *h.p. for take-off and* 665 (650) *h.p. at* 14,765 *ft.* **Armament:** (*Defensive*) *One hand-operated* 7.9-*mm. MG* 15 *machine gun on ball mounting in nose, one* 7.9-*mm. MG* 15 *on flexible mounting in dorsal position, and one* 7.9-*mm. MG* 15 *in rotatable semi-retractable ventral turret.* (*Offensive*) *Four* 551-*lb. SC* 250, *eight* 220-*lb. SC* 100, *or* 16 110-*lb. SC* 50 *bombs stowed internally in vertical cells.* **Performance:** *Maximum speed,* 205 (188) *m.p.h. at sea level,* 236 (224) *m.p.h. at* 13,120 *ft.; cruising speed,* 171 (156) *m.p.h. at sea level,* 211 (196) *m.p.h. at* 13,120 *ft.; tactical radius with maximum bomb load,* 286 (272) *mls., with* 882-*lb. bomb load,* 404 (390) *mls.; maximum range,* 870 *mls.; service ceiling,* 25,265 (24,610) *ft.* **Weights:** *Normal loaded,* 18,124 (18,078) *lb.* **Dimensions:** *Span,* 73 *ft.* 9¾ *in.; length,* 57 *ft.* 4 *in.* (58 *ft.* 7½ *in.*); *height,* 16 *ft.* 7¼ *in.; wing area,* 882.64 *sq. ft.*

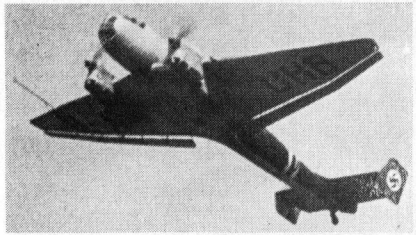
(*Right*) *The rear fuselage of a Ju* 86*G serving with IV/KG* 1 *in* 1939. *It will be noted that this aircraft has been modified by the introduction of lateral glazed blisters.*

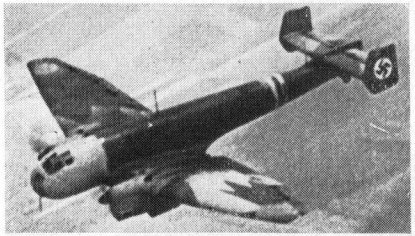
the two *Gruppen* had lost 42 aircraft by the end of January 1943. These transport units were finally disbanded in March and the surviving 16 Ju 86s were returned to the training establishments, but during 1943–44, some Ju 86s were once more detached from the schools for anti-partisan operations in the Balkans.

JUNKERS JU 86P

Despite the fact that, when World War II began, the *Luftwaffe* no longer envisaged using the Ju 86 operationally, this aircraft was still to make a somewhat spectacular operational début in the summer of 1940. Although interest had waned in the diesel engine as a bomber power plant, Junkers had persisted with the development of the Jumo 205, and in 1939, had evolved a high-altitude version, the Jumo 207 fitted with two centrifugal superchargers in series, the first of these being driven by an exhaust turbine, and with an aftercooler between the engine-driven super-







(*Above and left*) *The Ju* 86*P V*1 (*D-AUHB*) *during initial trials in* 1940.

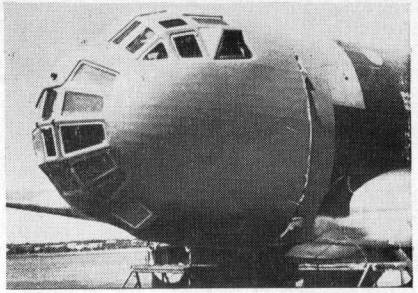
charger and the induction galleries. Junkers had also undertaken much research into the problems of high-altitude flight and pressure cabin design, and, in September 1939, approached the RLM with a project to adapt existing Ju 86 airframes for operation both as bombers and reconnaissance aircraft at extreme altitudes.

This project, which was dubbed "Ju 86H" by Junkers, was received with enthusiasm by the RLM which immediately gave instructions for work to commence at Dessau on three prototype conversions, the new variant receiving the official designation **Ju 86P**. The scheme called for the use of a Ju 86D airframe from which the dorsal and ventral gun positions were removed and faired over, and the provision of an entirely new forward fuselage taking the form of a completely self-contained two-seat pressure cabin. The cockpit canopy and the extreme nose comprised numerous flat Plexiglass dry-air sandwich windows, internal pressure was maintained at that equivalent to an altitude of 9,840 ft. by tapping the port engine-driven blower, and access to and egress from the cabin was provided by a circular hatch in the floor.

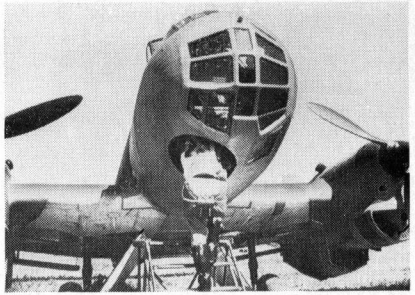
Powered by two Jumo 207A-1 six-cylinder

diesel engines each rated at 950 h.p. for take-off, the first prototype conversion, the **Ju 86P V1** (D-AUHB), was flown for the first time in February 1940, being joined in the following month by the second prototype conversion, the **Ju 86P V2**. Altitudes in excess of 32,800 ft. were attained at an early stage in the test programme, but it was soon realized that even more satisfactory results could be obtained by increasing the wing span, and the **Ju 86P V3** was fitted with extended wing outer panels increasing overall span from 73 ft. 9¾ in. to 83 ft. 11¾ in. With this modification, a maximum altitude of 39,700 ft. was attained, and altitudes of the order of 36,000 ft. were maintained for periods as long as two-and-a-half hours. Indeed, so successful were these trials that the RLM instructed Junkers to proceed with the conversion of 40 Ju 86Ds to Ju 86P standards before the test programme had been completed.

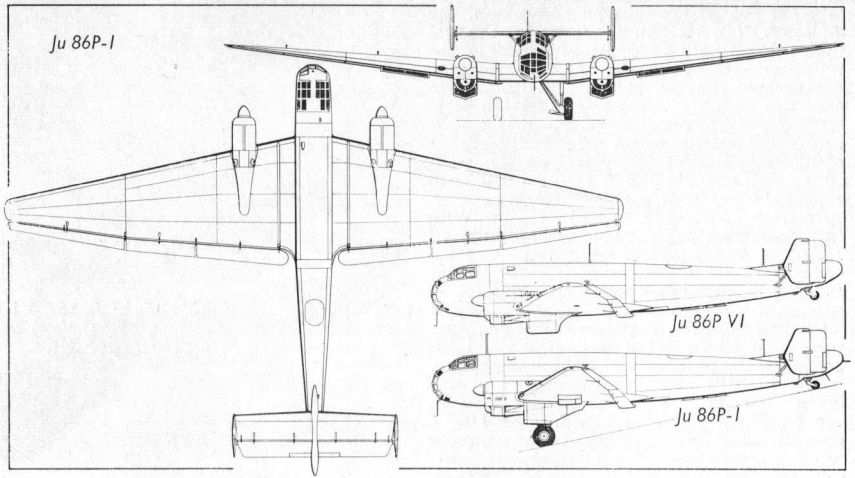
The Ju 86Ps were to be produced in two forms: the **Ju 86P-1** high-altitude bomber capable of carrying four 551-lb. or 16 110-lb. bombs, and the **Ju 86P-2** high-altitude reconnaissance aircraft with three automatic cameras. The proposed method of operation was to climb to an altitude of 36,090 ft. from take-off, this altitude being attained in 45 min. and a distance of 165 miles being covered during the course of the climb. The pilot would then maintain this altitude, cruising at 215 m.p.h., to within 125 miles of the target, whereupon a slow climb would be commenced to a maximum altitude of 39,370 ft., this being reached at a distance of 60 miles from the target. Thirty miles from the target the pilot would throttle back the engines and make a steep gliding approach to arrive over the target silently and presumably undetected at an altitude of 32,000–33,000 ft. After releasing the bombs the pilot would then open up the engines and climb back to



(*Above*) *The pressure cabin of the Ju* 86*P V*1 *being mated to the airframe, and* (*below*) *a crew member entering the Ju* 86*P V*1.



36,090 ft. for the return flight. No defensive armament was provided as it was assumed that the Ju 86P would perform its entire mission well above the attainable ceilings of existing fighters. Normal fuel capacity was



some 220 Imp. gal., this corresponding to an endurance of some four hours, and whereas the Ju 86P-1 had a maximum gross weight of 22,928 lb., that of the Ju 86P-2 was 20,944 lb.

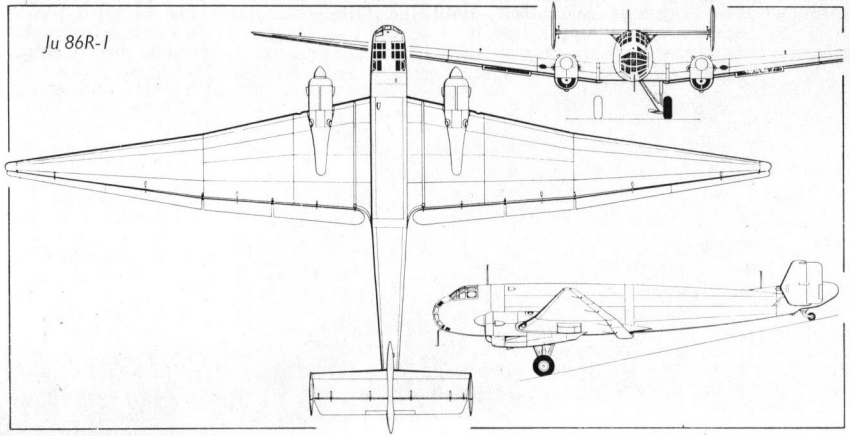
During the summer of 1940, one of the Ju 86P prototypes was delivered to the High Command's reconnaissance wing, the *Aufklärungsgruppe Ob.d.L.*, sometimes known as the *Aufklärungsgruppe Rowehl*, for operational evaluation, and during the course of trials a photographic reconnaissance sortie was flown over Britain during which an altitude of 41,000 ft. was attained, the aircraft remaining undetected. Several Ju 86P-1s and P-2s were delivered to 2./Aufkl.Gr.Ob.d.L. during the course of 1940, and a few missions were flown over the British Isles with indifferent success. In January 1941, a fourth *Staffel* was added to the *Gruppe*, 4./Aufkl.Gr.Ob.d.L., this also being known as the *Versuchsstelle für Höhenflüge* (Test Centre for High-Altitude Flight), its equipment including, among other aircraft, a number of Ju 86P-1s and P-2s. Operating from Northern Germany, this *Staffel* flew both bombing and reconnaissance missions over the British Isles, proving its aircraft immune from interception. It also flew a number of reconnaissance missions over the Soviet Union in preparation for the assault on that country, 4./Aufkl.Gr.Ob.d.L. operating from Bucharest and Cracow for these sorties. With the invasion of the Soviet Union and the transfer of the first three *Staffeln* of the Aufkl.Gr.Ob.d.L. to the

JUNKERS JU 86R-1 SPECIFICATION
(Data in parentheses relates to the Ju 86P-1)

Type: *Two-seat High-Altitude Photographic Reconnaissance (Bomber) Aircraft.* **Power Plants:** *Two Junkers Jumo* 207*B*-3 (*A*-1) *six-cylinder vertical opposed-piston compression-ignition two-stroke engines each rated at* 1,000 (950) *h.p. for take-off and* 750 (680) *h.p. at* 40,000 (32,000) *ft.* **Armament:** (*One remotely-controlled aft-firing* 7.9-*mm. MG* 17 *machine gun optional. Four* 551-*lb. or* 16 110-*lb. bombs stowed internally in vertical cells.*) **Performance:** *Maximum speed,* 261 (224) *m.p.h. at* 29,527 (19,685) *ft.,* 230 (186) *m.p.h. at* 45,930 (39,370) *ft.; long-range cruising speed,* 155 (161) *m.p.h. at* 44,950 (36,090) *ft.; normal range,* 620 (645) *mls.; maximum range,* 1,085 *mls.; service ceiling,* 47,250 (39,370) *ft.* **Weights:** *Empty,* 14,947 (15,432) *lb.; maximum loaded,* 25,420 (22,930) *lb.* **Dimensions:** *Span,* 104 *ft.* 11¾ *in.* (83 *ft.* 11¾ *in.*)*; length,* 54 *ft.* 0 *in.* (54 *ft.* 0 *in.*)*; height,* 13 *ft.* 4½ *in.* (13 *ft.* 4½ *in.*)*; wing area,* 1,049.48 *sq.ft.*

Russian Front for operation in the conventional reconnaissance role, 4.*Staffel* remained in the West, continuing its high-altitude activities.

With the disbanding of 4./Aufkl.Gr.Ob.d.L. in January 1942, and the formation of the *Versuchsverband Ob.d.L.* at Berlin-Rangsdorf, the Ju 86Ps were transferred to the 1.*Staffel*



A Ju 86R-1 high-altitude reconnaissance aircraft of the Versuchsverband Ob.d.L.

of the new unit which continued to use them operationally in the desultory fashion of its predecessor. In May 1942, several of the Ju 86P-2s were detached to the Mediterranean Theatre, appearing over Egypt, and performing their missions unscathed until August 24th when one of the photo-reconnaissance aircraft was intercepted just north of Cairo at 37,000 ft. by a specially-stripped Spitfire V. After a long chase, during which the interceptor and its quarry climbed to 42,000 ft., the starboard engine of the Ju 86P-2 was set on fire and the aircraft crashed in the Mediterranean. So-called "respect armament" was hastily fitted in the form of a single remotely-controlled 7.9-mm. MG 17 machine gun fixed to fire aft from the rear fuselage but, nevertheless, two more Ju 86P-2s were lost to the specially-modified

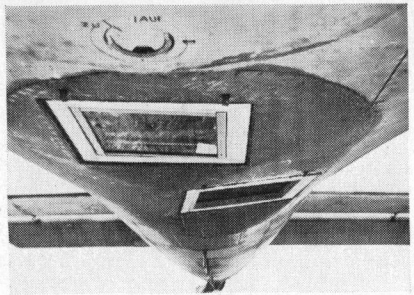
(*Left*) *Forward fuselage of Ju 86P-1 (Werk-Nr. 0439) high-altitude bomber.*

Spitfire Vs operating from Aboukir, and the survivors were finally withdrawn.

JUNKERS JU 86R

As it was obvious that the Allies would eventually develop fighters capable of intercepting the Ju 86P at the maximum altitudes at which it could operate, a further development of the basic aircraft was initiated with the aim of attaining even greater altitudes, this being designated Ju 86R. As an even higher aspect ratio than that of the wing of the Ju 86P was necessary, the outboard wing panels were again extended to result in an overall wing span of 104 ft. 11¾ in. and an almost grotesque appearance. The modified wing was accompanied by the installation of Jumo 207B-3 engines which, offering 1,000 h.p. for take-off and 750 h.p. at 40,000 ft., employed GM-1 (nitrous oxide injected into the supercharger) for use above the rated altitude of the engine. Provision was made for a maximum fuel load of 426 Imp. gal., corresponding to an endurance of approximately 7 hr. 10 min., four-blade airscrews replaced the three-bladers of the Ju 86P, and two versions were proposed: the **Ju 86R-1** high-altitude reconnaissance aircraft with a similar camera arrangement to that of the Ju 86P-2, and the **Ju 86R-2** high-altitude bomber with similar bomb capacity to that of the Ju 86P-1.

The conversion of a small number of Ju 86P-1s to R-2 standards and Ju 86P-2s to R-1 standards began at Dessau during the spring of 1942, and during trials it was ascertained that the Ju 86R could attain and maintain an altitude of 47,250 ft. Relatively few conversions were undertaken, a small number of Ju 86R-1s being delivered to the *Versuchsverband Ob.d.L.* Some reconnaissance operations were carried out with these, and four remained on the strength of 1.*Staffel* in February 1944, but had disappeared entirely from the unit's



(*Above*) *The ventral camera ports of the Ju 86P-2. Three automatic cameras were normally fitted.*

inventory by the end of July of that year

Prior to the service introduction of the Ju 86R-1, the Junkers team had set its sights even higher, its aim being the attainment of a ceiling of no less than 52,500 ft. To achieve this the **Ju 86R-3** was proposed, this version being powered by a further development of the Jumo 205 diesel, the Jumo 208 which it was anticipated would offer 1,500 h.p. for take-off and 1,100 h.p. at 40,000–50,000 ft. The Jumo 208s were to be supercharged by means of a Daimler-Benz DB 605T located in the fuselage and driving a two-stage blower. However, the abandoning of further development of the Jumo 208 before it attained flight test status necessitated plans for the Ju 86R-3 being dropped, together with those for a parallel project, the **Ju 186**, which, employing a Ju 86P fuselage, was to have been a high-altitude research aircraft with a fixed undercarriage and powered by either four Jumo 208s or two Jumo 218s (coupled Jumo 208s).

JUNKERS JU 87

GERMANY

No warplane of World War II was more widely discussed nor aroused greater controversy than the Ju 87, an angularly ugly dive-bomber enjoying greater notoriety than any aircraft in the *Luftwaffe's* inventory. This Junkers product, which became synonymous with the abbreviation "Stuka"—from *Sturzkampfflugzeug*, a term descriptive of all dive-bombers—was even a subject for controversy within the *Oberkommando der Luftwaffe* (OKL) itself, but its advocates believed it the supreme weapon, and their claims for its invincibility, propagated so assiduously, appeared borne out by the almost legendary reputation with which it emerged from the Polish and French campaigns.

The Ju 87 *was* an evil-looking machine, with something of the predatory bird in its ugly contours—its radiator bath and fixed, spatted undercarriage resembling gaping jaws and extended talons—and the psychological effect on the recipients of its attentions appeared almost as devastating as the bombs that it delivered with such accuracy. It was an extremely sturdy warplane, with light controls, pleasant flying characteristics and a relatively high standard of manoeuvrability. It offered its crew members good visibility and it was

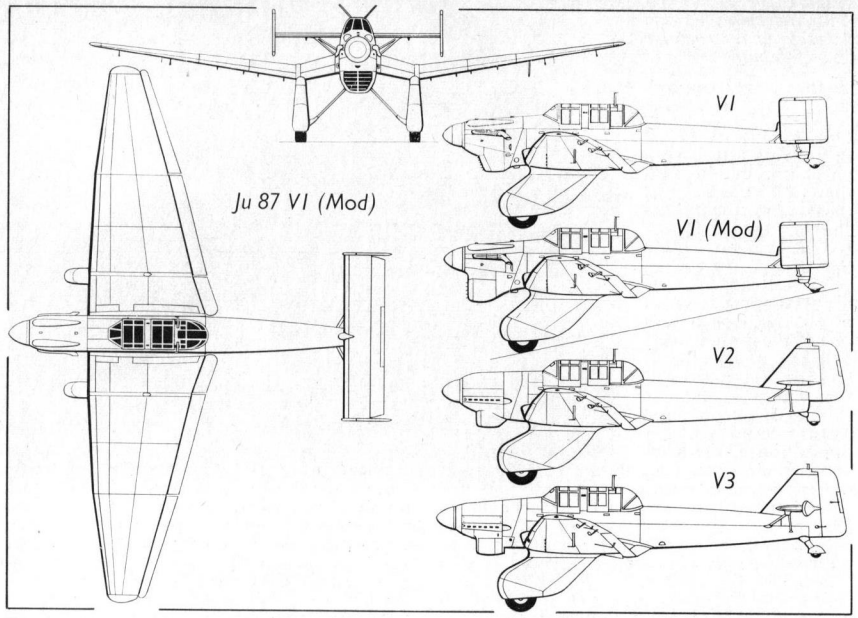
(*Left and below*) *The Ju 87 V1 in the form in which it was originally flown.*

(*Right*) *The Ju 87 V1 after the enlarging and redesign of the radiator bath.*

able to hit its target in a diving attack with an accuracy of less than 30 yards. All these were highly desirable characteristics but they tended to blind the Ob.d.L. to the Ju 87's shortcomings. Its use presupposed control of the air, for it was one of the most vulnerable of combat aircraft and the natural prey of the fighter, and as soon as it encountered determined fighter opposition in the skies above the British Isles the Ju 87's dramatic career entered its eclipse.

Design work on the Ju 87 was begun in 1933 by Dipl. Ing. Pohlmann of the Junkers-Flugzeugwerke to fulfil the second phase of the *Sturzbomber* programme initiated in that year. The first phase, or *Sofort-Programm* (Immediate Programme), which was to result in the Fi 98 and Hs 123, was intended to produce a relatively conventional biplane in the least possible time as interim equipment for the planned *Stukagruppen*, while the second phase envisaged an appreciably more advanced warplane equipped with dive brakes and accommodating two crew members, and possessing a performance more closely comparable with those of contemporary fighters. In the event, the second phase *Sturzbomber* specification was not issued by the *Technische Amt* of the RLM until January 1935, and although this was delivered to Arado, Heinkel and Junkers simultaneously, the intention being ostensibly to select the final aircraft from designs submitted by the three manufacturers on a competitive basis, the specification had been drawn up around the Ju 87, the construction of three prototypes of which had begun in the summer of the previous year with the sanction of the RLM, thus placing the Junkers-Flugzeugwerke at a considerable advantage.

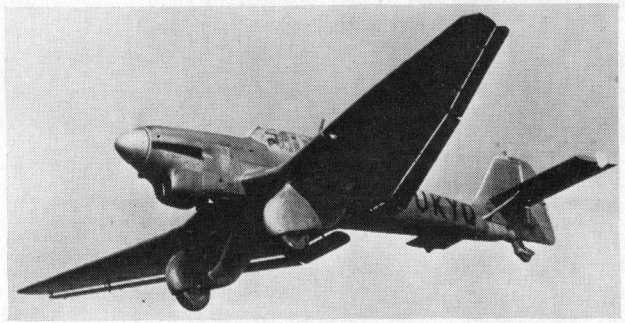
Within three months of the issue of the definitive specification, the first prototype of the Junkers dive-bomber, the **Ju 87 V1**, had been rolled out and had commenced its flight test programme at Dessau. Of all-metal



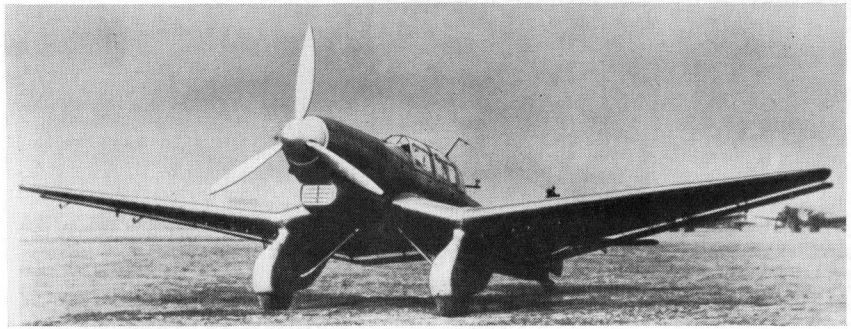
stressed-skin construction, the Ju 87 V1 featured an oval-section fuselage built in two halves and joined along the centreline, the smooth metal skin being riveted to Z-section frames and open-section stringers. The wing was basically a two-spar structure with closely-spaced ribs, the centre section being built integral with the fuselage and set at a coarse anhedral angle which, with the sharp dihedral angle adopted for the outer wing panels, resulted in a characteristic inverted gull configuration. The entire wing trailing edge was hinged on the Junkers "double-wing" principle, the outer portions acting as ailerons and the inner portions as flaps, and the braced tailplane carried rectangular endplate vertical surfaces. The two crew members were seated back-to-back beneath a continuous canopy

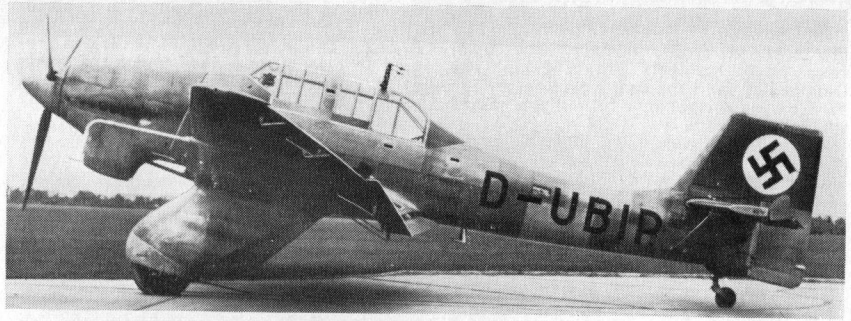
incorporating hinged sections over each seat, and immense fairings, braced to the fuselage by single inclined struts, enclosed the main undercarriage members attached to the extremities of the wing centre section.

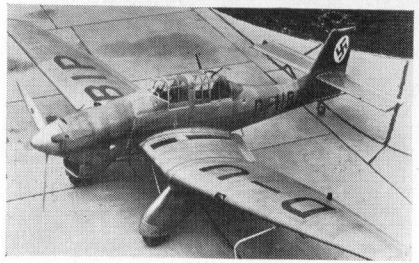
Power was provided by a fully-supercharged Rolls-Royce Kestrel V 12-cylinder upright-Vee liquid-cooled engine rated at 525 h.p. for take-off and 640 h.p. at 14,000 ft., and driving a two-bladed fixed-pitch wooden airscrew. During initial flight trials some over-heating of the Kestrel engine was experienced, necessitating the introduction of a substantially enlarged chin-type radiator bath at an early stage in the test programme. It was proposed to attach air brakes under the wings just aft of the leading edges and outboard of the main undercarriage fairings, these taking



(*Below*) *The Ju 87 V2, the first Jumo-engined prototype, and* (*right*) *the Ju 87 V3.*







(Above and left) The Ju 87 V4 (D-UBIP), production prototype for the Ju 87A.

the form of slats turning through 90° in a dive. These brakes were not ready when the first diving trials took place during the summer of 1935, and shortly after these trials began, the entire tail assembly began to oscillate during a medium-angle dive, the starboard vertical surface parting company with the rest of the tail when the pilot attempted to recover from the dive, and the aircraft crashing.

At the time of the accident, the second prototype, the **Ju 87 V2** powered by a Junkers Jumo 210Aa 12-cylinder inverted-Vee liquid-cooled engine rated at 610 h.p. at 8,550 ft. and driving a three-blade variable-pitch airscrew, was being readied to participate in the test programme, but trials were delayed pending an investigation of the Ju 87 V1's crash, its findings resulting in the hurried redesign of the tail assembly, the twin vertical surfaces giving place to a centrally-mounted single-fin-and-rudder assembly which increased overall length from 33 ft. 1¼ in. to 34 ft. 10¾ in. The test programme was resumed in the late autumn of 1935, the third prototype, the **Ju 87 V3** (D-UKYQ), joining the V2 shortly before the end of the year, this embodying a number of changes dictated by trials with the earlier aircraft, the principal of these being modification of the engine bearers to

lower the Jumo 210Aa engine and thus improve the pilot's forward view. This change was accompanied by further redesign of the vertical tail surfaces which were substantially enlarged, and the addition of small endplate fins to the horizontal surfaces.

The Ju 87 V2 was fitted with dive brakes prior to its delivery to the *Erprobungsstelle* at Rechlin for official evaluation in March 1936, and participated in the comparative trials between the four contenders for the dive-bomber production contract, the Ju 87 V3 serving as a reserve aircraft. Although the dive-bombing concept possessed many adherents in the *Luftwaffe*, it also had resolute opponents, one of these being *Oberst* Wolfram von Richthofen, chief of the Development Section of the RLM's *Technische Amt*, who, on June 9, 1936, issued a confidential directive calling for the discontinuation of further development of the Ju 87. On the following day, however, Ernst Udet, the dive-bomber's most ardent supporter, took over the *Technische Amt* and immediately rescinded von Richthofen's directive. Competing with the Ju 87 were the Arado Ar 81, the Heinkel He 118 and the Hamburger Flugzeugbau's Ha 137, the last-mentioned type being a late entry in the contest, but such was Junkers' confidence in the outcome of the Rechlin trials that the company's production prototype, the **Ju 87 V4** (D-UBIP), was virtually complete at Dessau, and tooling had already begun for a pre-production batch of 10 aircraft. Thus, many were convinced that the RLM's announcement of the choice of the Ju 87 as future equipment for the *Stukagruppen* was little more than a formality.

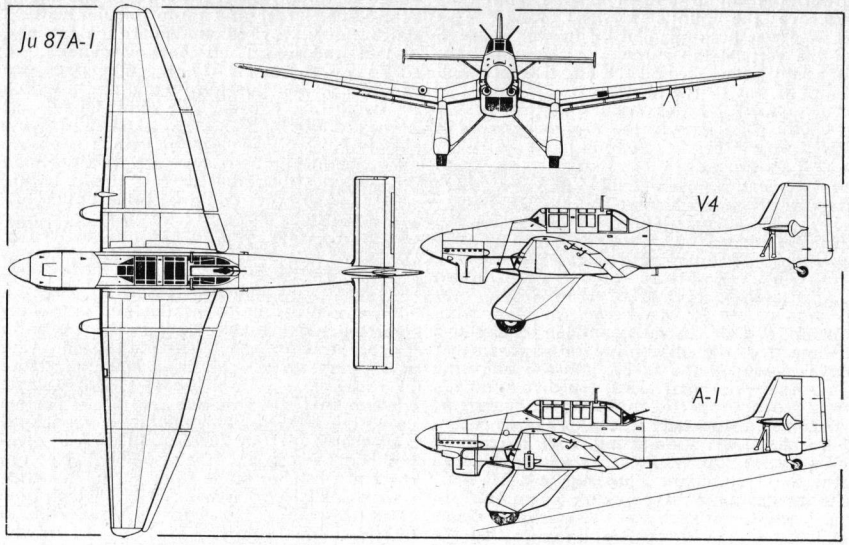
JUNKERS JU 87A

The "productionization" of the basic Ju 87 design had begun early in 1936, and most of the revisions were embodied by the Ju 87 V4 which featured further lowering of the engine centre-line, larger and more angular vertical tail surfaces, revised undercarriage fairings, and a redesigned aft cockpit canopy. A single 7.9-mm. MG 17 machine gun was mounted in the starboard wing, and a crutch on swing links was attached immediately aft of the radiator bath, this lowering and swinging the bomb forward on release to ensure clearance of the airscrew arc. This crutch could carry either a 551-lb. or 1,102-lb. bomb, although the latter could be lifted only when the aircraft was flown as a single-seater.

The pre-production **Ju 87A-0** differed from the Ju 87 V4 in two respects: the Jumo 210Aa gave place to the Jumo 210Ca rated at 600 h.p. for take-off and 640 h.p. at 8,860 ft., and as a further concession to production simplification, the break in the leading-edge taper on the outer wing panel was eliminated, wing area being maintained at a constant figure by an increase in trailing-edge taper. A single 7.9-mm. MG 15 machine gun on a flexible mounting was provided in the rear cockpit.

The first pre-production Ju 87A-0 dive-bombers had come off the assembly line before the end of 1936, being followed by the production **Ju 87A-1** early in 1937, at which time Ob.d.L. planning called for six *Stukagruppen* of which four were to be equipped with the Ju 87, these being I and II/St.G.162 (later to be redesignated St.G.163 and, subsequently, St.G.2), I/St.G.262 (eventually activated as III/St.G.162 and later redesignated I/St.G.2), and III/St.G.165 (later redesignated III/St.G. 51). Each *Gruppe* was to have 36 aircraft plus three per *Gruppenstab* to provide a first-line strength of 154 Ju 87s.

During the early spring of 1937, I/St.G.162 "Immelmann" had begun conversion from the Hs 123A to the Ju 87A-1 and was entrusted with the working up of the new aircraft for service use and the development of effective

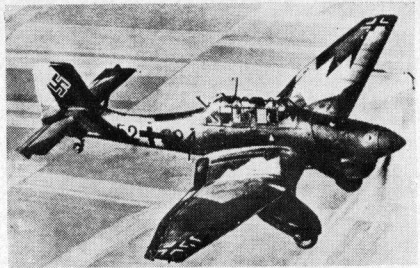


JUNKERS JU 87A-1 SPECIFICATION

Type: *Two-seat Dive-Bomber.* **Power Plant:** *One Junkers Jumo* 210*Ca* 12*-cylinder liquid-cooled engine rated at* 600 *h.p. for take-off and* 640 *h.p. at* 8,860 *ft.* **Armament:** *One fixed forward-firing* 7.9*-mm. MG* 17 *machine gun and one* 7.9*-mm. MG* 15 *machine gun on flexible mounting in rear cockpit. (Offensive) One* 551*-lb. or (as single-seater)* 1,102*-lb. bomb.* **Performance:** *Maximum speed (without external load),* 199 *m.p.h. at* 12,140 *ft., (with* 551*-lb. bomb),* 183 *m.p.h. at* 9,840 *ft.; maximum cruising speed,* 171 *m.p.h. at* 8,860 *ft.; maximum range,* 620 *mls. at* 162 *m.p.h.; service ceiling,* 22,965 *ft.* **Weights:** *Empty,* 5,104 *lb.; maximum loaded,* 7,495 *lb.* **Dimensions:** *Span,* 45 *ft.* 3⅛ *in.; length,* 35 *ft.* 5¼ *in.; height,* 12 *ft.* 9½ *in.; wing area,* 343.368 *sq. ft.*

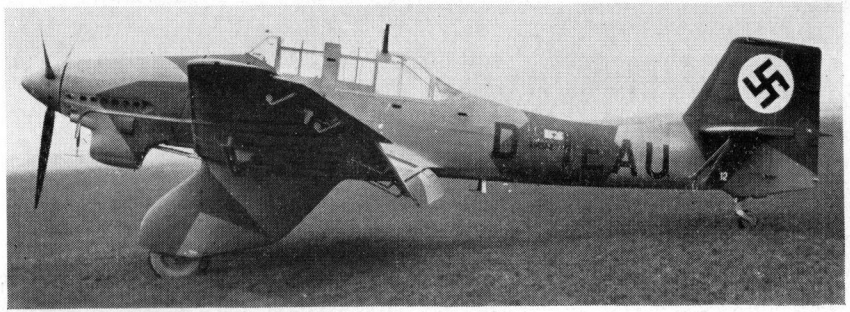
operational tactics, and late in 1937, a *Kette* of three aircraft from this *Gruppe*, which, by this time, had been redesignated St.G.163, was despatched to Spain to test the dive-bombing techniques under operational conditions with the Condor Legion. The trio of Ju 87A-1s first saw action at Teruel, subsequently participating in the Nationalist drive to the Mediterranean coast, in the fighting on the Ebro front and in the Catalonian offensive. Personnel from St.G.163 were posted to the *Kette* in Spain on a roster basis.

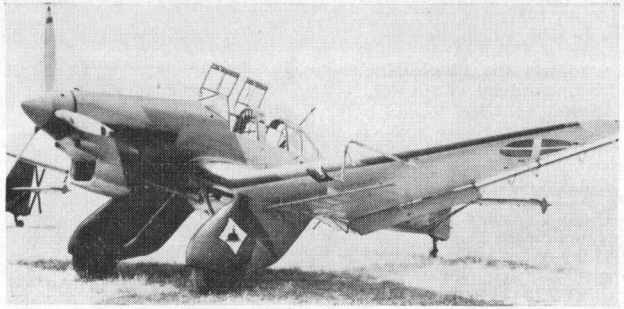
The Ju 87A-1 was supplanted on the Dessau assembly line late in 1937 by the **Ju 87A-2** which differed from its predecessor in having a Jumo 210Da engine with two-speed supercharger and rated at 680 h.p. for take-off and 670 h.p. for five minutes at 12,800 ft., this driving a broader-bladed airscrew. Whereas later models of the Ju 87 were to employ automatic supercharger gear and a governor providing automatic constant-speed action by regulating the pitch of the airscrew, the Ju 87A-2 enjoyed no such refinements, and before commencing a dive its pilot had to throttle back in order to close the cooling gills, switch over to the sea-level supercharger, and turn the airscrew to coarse pitch. After pulling out



A Ju 87*A*-1 *of St.G.*163 *(formerly St.G.*162*) late in* 1937.

The 12*th production Ju* 87*A*-1 *(D-IEAU) delivered in the spring of* 1937 *to I/St.G.*162 *'Immelmann'.*

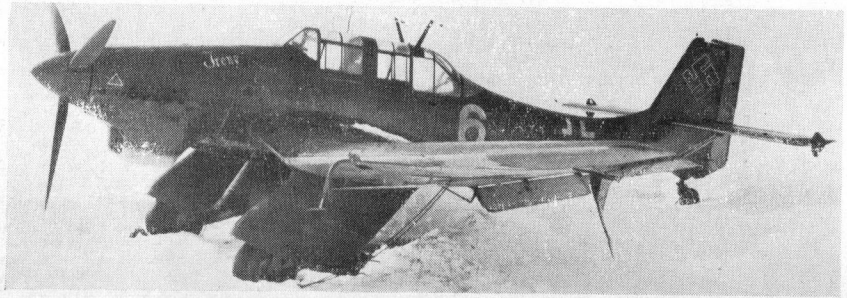




(*Left*) *A Ju 87A-1 serving in Spain in 1938, and (at foot of page) a Ju 87A-2 serving in the role of dive-bomber trainer during the winter of 1940–41.*

of the dive and retracting the brakes, the position of which was revealed by small red indicators protruding from the upper wing surfaces, the pilot had to open the cooling gills immediately to avoid overheating the engine. A series of lines painted at various angles on the cabin side panels were aligned with the horizon by the pilot to facilitate aiming.

With the availability of the appreciably more powerful Jumo 211, which was essentially an enlarged version of the Jumo 210, the opportunity was taken late in 1937 to initiate a major redesign of the basic aircraft, and by the late spring of 1938, production of the Ju 87A-2 was in process of phasing out at Dessau, some 200 A-series aircraft having been delivered to the *Luftwaffe* when the last



left the assembly line in the early summer, and when hostilities began in 1939, all Ju 87As had been withdrawn from first-line service and turned over to training units.

JUNKERS JU 87B

The Jumo 211A engine had been tested in a modified Ju 87A-1 airframe which, redesignated **Ju 87 V6**, had flown early in 1938, this being followed by the more extensively modified **Ju 87 V7**, the first prototype for the Ju 87B series, a pre-production batch of 10 examples of which followed the last Ju 87A-2s on the Dessau assembly line. Simultaneously, preparations were being made to transfer responsibility for Ju 87B production from Junker's Dessau factory to the Berlin-Tempelhof plant of the "Weser" Flugzeugbau, which, by the following autumn, had begun deliveries of the Ju 87B-1.

The pre-production **Ju 87B-0** was powered, like the Ju 87 V7, by a Jumo 211A offering 1,000 h.p. for take-off and 975 h.p. at 13,780 ft., both being five-minute ratings at 2,300 r.p.m., but during the course of 1938, a version of this engine in which the carburettors were replaced by direct fuel-injection became available, and this, the Jumo 211Da, which operated at 2,400 r.p.m. to provide a take-off and emergency power of 1,200 h.p., was standardized for the production model, the **Ju 87B-1**. By comparison with the Ju 87A only the wings and horizontal tail surfaces of the Ju 87B remained unchanged, the remainder of the dive-bomber embodying both aerodynamic and structural redesign. The entire fuselage was recontoured; the cockpit canopy was redesigned, sliding sections replacing the folding hatches; the vertical tail surfaces were further enlarged, and the trousered mainwheel housings braced to the fuselage gave place to cantilever units with streamlined "spats". The substantial increase in power afforded by the Jumo 211Da enabled a 1,102-lb. bomb to be lifted by the ventral crutch with the full crew complement, an alternative warload comprising a single 551-lb. bomb on the crutch and four 110-lb. bombs on underwing racks, and forward-firing armament was augmented by a 7.9-mm. MG 17 machine gun in the port wing.

Five of the first production Ju 87B-1s were despatched to Spain in October 1938, these emulating the considerable success enjoyed by the trio of Ju 87As that had preceded them, and with the transfer of the assembly line to the "Weser" Flugzeugbau, production tempo rose rapidly. Whereas only 395 Ju 87s, including prototypes, were delivered throughout 1937 and 1938, output at the Berlin-Tempelhof factory was exceeding 60 per month by mid-1939, total production for the year attaining 557 aircraft, and all nine *Stukagruppen* included in the *Luftwaffe*'s order of battle on September 1, 1939 had re-equipped with the Ju 87B-1, these possessing 336 aircraft of which 288 were serviceable.

The **Ju 87B-2**, which succeeded the B-1 on the "Weser" assembly line late in 1939, incorporated a number of refinements, such as ejector exhausts, hydraulically-operated radiator cooling gills, and an improved airscrew with broader blades. When flown as a single-seater the Ju 87B-2 could carry a maximum bomb load of 2,205 lb., and similar field modifications to those evolved for the Ju 87B-1 in the light of operational experience could be applied to the improved model. For example, the application of updated communications radio had resulted in the **Ju 87B-1/U2**, and with similar equipment changes on the later production version this became the **Ju 87B-2/U2**. Additional armour for the close-support mission was fitted to the **Ju 87B-2/U3**, while the **B-2/U4** had skis in place of the standard wheel

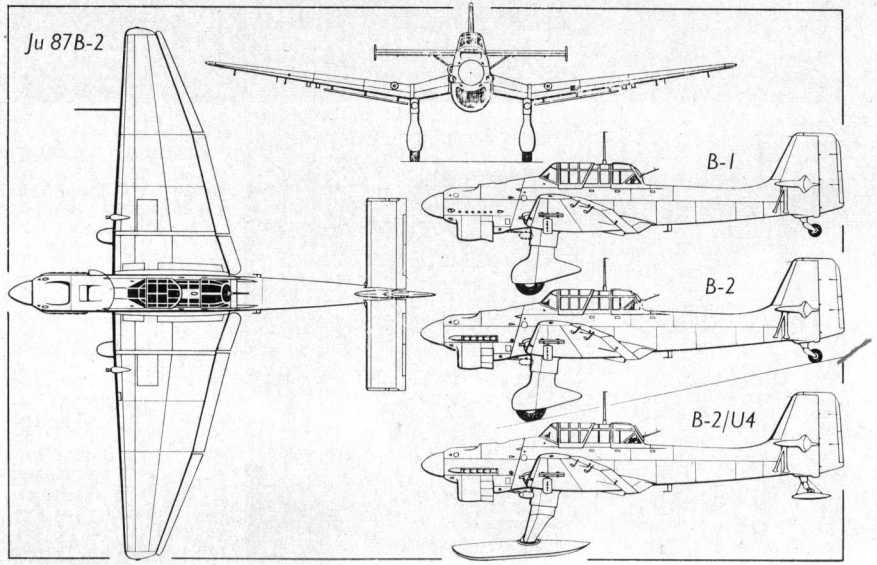
(Above) A pre-production Ju 87B-0 (D-IELX), and (left) a Ju 87B-1 serving with 4. Staffel of II/St. G. 77 and fitted with SC 50K bombs with Dienartstab extended percussion fuses.

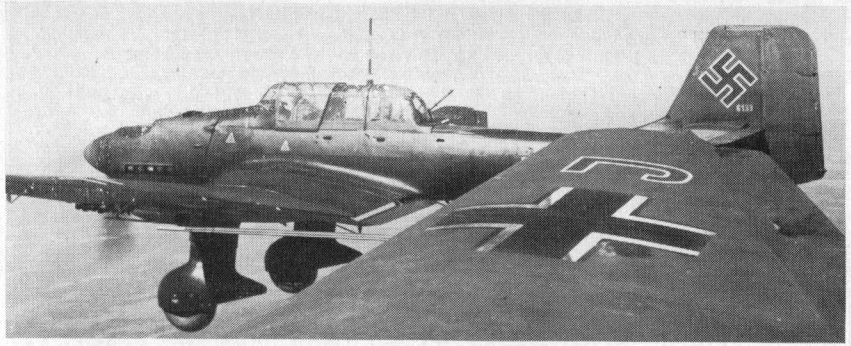
undercarriage. With sand filters and desert survival equipment the aircraft was designated **Ju 87B-2/Trop**, and, together with the standard Ju 87B-2, the tropicalised version was delivered to Italy's *Regia Aeronautica* from the summer of 1940. The Ju 87B-2 and B-2/Trop subsequently saw operational service in the Balkans, the Mediterranean and North Africa with the Italian 96°, 97°, 101°, 102° and 121° *Gruppi Tuffatori*. Other Ju 87B-2s were supplied to the air arms of Bulgaria and Hungary.

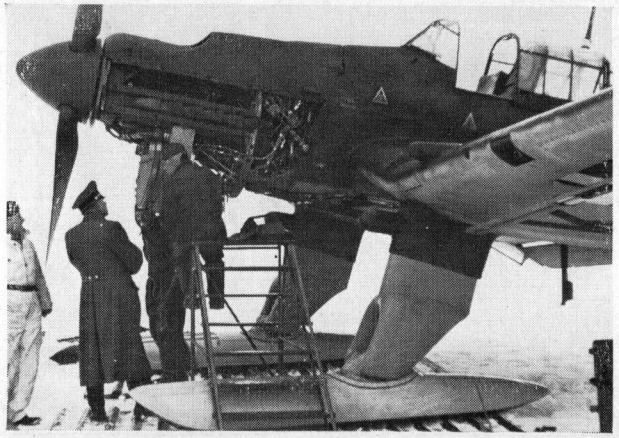
In some quarters of the *Luftwaffe*, the Ju 87 was regarded as obsolescent before W.W.II began owing to its relatively low speed and vulnerability, and it was planned to phase this dive-bomber out of production by the end of 1939, but its successes during the Polish campaign strengthened the influence of the pro-*Stuka* factions in their demands for continued production of the Ju 87, and these were upheld by Göring, with the result that production, instead of being phased out, was increased, a total of 611 being delivered during

JUNKERS JU 87B-1 SPECIFICATION

Type: *Two-seat Dive-Bomber.* **Power Plant:** *One Junkers Jumo 211Da 12-cylinder liquid-cooled engine rated at 1,200 h.p. for take-off and 1,100 h.p. at 4,920 ft.* **Armament:** *Two fixed forward-firing 7.9-mm. MG 17 machine guns and one 7.9-mm. MG 15 machine gun on flexible mounting in rear cockpit. (Offensive) One 1,102-lb. bomb or one 551-lb. and four 110-lb. bombs.* **Performance:** *Maximum speed, 211 m.p.h. at sea level, 238 m.p.h. at 13,410 ft.; maximum cruising speed, 209 m.p.h. at 12,140 ft.; economical cruising speed, 175 m.p.h. at 15,090 ft.; maximum range (with 1,102-lb. bomb), 370 mls., (without external load), 490 mls.; time to 3,280 ft., 2 min., to 6,560 ft., 4.3 min., to 12,190 ft., 12 min.; service ceiling, 26,250 ft.* **Weights:** *Empty, 5,980 lb.; empty equipped, 6,090 lb.; maximum loaded, 9,560 lb.* **Dimensions:** *Span, 45 ft. 3⅛ in.; length, 36 ft. 5 in.; height, 13 ft. 2 in.; wing area, 343.368 sq. ft.*







(Above) A Ju 87B-2 of IV (St)/LG 1, and (left) a Ju 87B-2/U4 on which skis supplanted the standard wheel undercarriage.

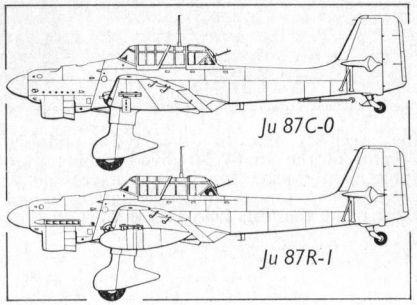
the course of 1940. The achievements of the *Stukagruppen* during the French campaign fulfilled the most sanguine expectations of the Ju 87's protagonists, but the shock administered by the Battle of Britain was sufficient to disenchant some of the most ardent. Nevertheless, the legend of the Ju 87's general-purpose value persisted, and as it was not clear what aircraft would replace it, the decision to phase out production was once more delayed, and in the late spring of 1941, the Ju 87B-2 gave place on the assembly lines to the Ju 87D-1.

JUNKERS JU 87C

During the course of 1938, a decision had been taken to include a *Staffel* of dive-bombers in the air complement of "Carrier A" which, at the end of that year, was to be christened the *Graf Zeppelin*, and Junkers initiated the navalization of the Ju 87B under the designation Ju 87C. Featuring catapult spools and arrester gear, jettisonable main undercarriage members for emergency landings on water, flotation equipment and manually-folded outer wing panels, the pre-production **Ju 87C-0** appeared on the "Weser" assembly line during the summer of 1939, and at this time it was proposed that the definitive shipboard **Ju 87C-1** should feature electrically-actuated wing folding mechanism, and provision for carrying a single torpedo as an alternative to bombs beneath the fuselage, and additional fuel tankage in the wings.

The small batch of Ju 87C-0 dive-bombers was issued to 4.(*Stuka*)*Staffel* of the *Trägergruppe* 186, this *Staffel*, which was intended to eventually operate from the *Graf Zeppelin*, having been formed during the previous December at Kiel-Holtenau on Ju 87As. At the beginning of September 1939, 4.(St)/Tr.Gr. 186 was operating 12 Ju 87B-1s and C-0s, and was promptly assigned to 1.*Fliegerdivision* for the assault on Poland, operating under II and III/St.G.2.

Early in the Polish campaign, one of the Ju 87C-0s of 4.(St)/Tr.Gr. 186 was damaged by anti-aircraft fire while attacking the Polish naval base at Hela, and its pilot actuated the explosive bolts which jettisoned the main undercarriage members in preparation for an emergency landing on the water. In the event, he succeeded in retaining control of the aircraft, successfully regaining his base where he made a belly landing. This incident was subsequently used by German propagandists as "evidence" of the structural integrity of the Ju 87. During the return flight to its base, the Ju 87C-0 devoid of undercarriage had been photographed from an accompanying aircraft,



the photograph being widely distributed but the caption stating that the undercarriage had been lost when the aircraft hit the water while pulling out of a dive.

When hostilities in Europe began, the *Graf Zeppelin* was 85 per cent complete, and most of her machinery had been installed, but a month later the uselessness of a single carrier operating in the confined and exposed waters of the North Sea was appreciated, work on the vessel being suspended. Consequently, a batch of Ju 87C-1 shipboard aircraft at that time under construction by "Weser" was cancelled and the aircraft converted on

(*Left*) *A Ju 87R-2 of St.G.1 photographed over Sicily in May* 1941.

the assembly line to Ju 87B-2 standards. Several of the Ju 87C-0 dive-bombers were subsequently used for various experimental programmes, one of the most interesting of these being the tests held at Treuburg in East Prussia in 1944 with an 88-mm. recoilless gun. This weapon, which worked on the counter-recoil principle, compensating thrust being derived from a rocket charge fired simultaneously with the shell, was mounted beneath the forward fuselage of a Ju 87C-0, part of the fuselage being cut away to provide space for the shell and rocket magazines. The gun fired through the air-screw disc, but tests terminated when the rocket charge failed to ignite and the recoil tore away the gun housing, ripping through the underside of the fuselage and damaging the tail.

(*Left*) *Ju 87B-2 with the Hungarian Air Force.*

JUNKERS JU 87R

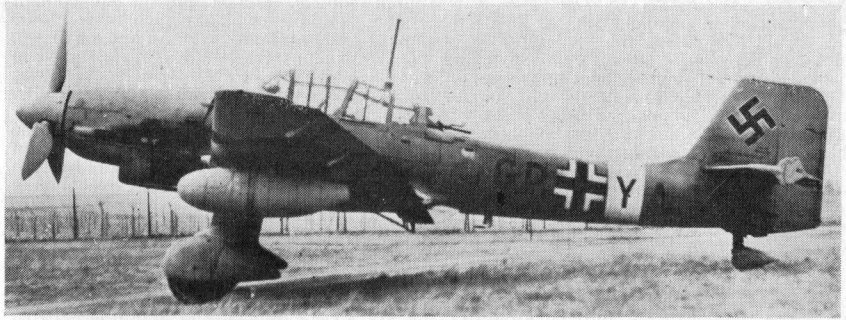
Manufactured in parallel with the Ju 87B-2 was the Ju 87R series, the "R" suffix letter indicating *Reichweite* (Range), and referring to the substantial improvement in this aspect of the performance to suit the aircraft for anti-shipping operations and other extended-range missions. Minor structural changes enabled the 52.8 Imp. gal. fuel tank in each wing root to be supplemented by a 33 Imp. gal. auxiliary tank in each outer wing panel, and "wet" points were provided in place of the normal underwing bomb racks, enabling two 66 Imp. gal. drop tanks to be carried. Restricted to a maximum offensive load of a single 551-lb. bomb, the **Ju 87R-1** was identical to the Ju 87B-2 apart from the previously-mentioned modifications, and the **Ju 87R-2**, **R-3** and **R-4** differed primarily in the type of equipment installed, the changes being associated for the most part with the radio. The Ju 87R began to enter service early in 1940, I/St.G.1 re-equipping with this version of the dive-bomber in time to participate in Operation *Weserübung*, the invasion of Denmark and Norway, in April.

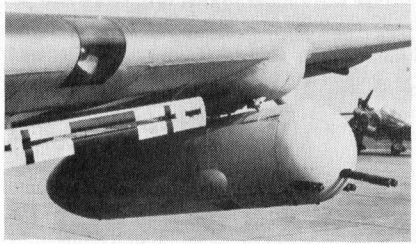
One example of the Ju 87R was later employed for trials with the so-called *Dobbas* collapsible freight and equipment container. This aerofoil-shaped container was intended to carry spares when units were moving from one operational field to another, or urgently-needed freight, and was slung between the main undercarriage members, being attached to the standard central bomb rack.

JUNKERS JU 87D

From the spring of 1940, work began on a refined version of the basic Ju 87 design capable of taking full advantage of the new Jumo 211J-1 engine with induction air cooler, a strengthened crankshaft, a fully-shrouded DVL supercharger impeller, modified boost and injection pump control, and a pressurized coolant system. This power plant, which offered 1,400 h.p. at 2,600 r.p.m. for take-off and 1,410 h.p. at 2,700 r.p.m. at 14,100 ft., was installed in the Ju 87D in which a serious attempt was made to clean up the aircraft aerodynamically. The engine cowling lines were improved by removing the oil cooler from the top of the cowling and placing it beneath the cowling in the position previously occupied by the coolant radiator, simultaneously placing the coolant radiator beneath the wing centre section. The cockpit canopy was completely redesigned to reduce drag, the main undercarriage fairings were reduced in size and simplified, the vertical tail surfaces, although retaining the basic outline of those of earlier Ju 87s, were enlarged, and the internal fuel tankage was similar to that of the Ju 87R.

Crew armour was increased, the pilot's seat being completely armoured with 4-mm. and 8-mm. plate, a 10-mm. armour headshield and 5-mm. floor armour were introduced, and head and side plates were provided the gunner. The two fixed forward-firing 7.9-mm. MG 17 machine guns were retained but aft-firing armament was increased to two MG 17s which were replaced early in the production run by a pair of MG 81s of similar calibre, and maximum bomb load was raised to 3,968 lb., although normally the **Ju 87D-1** carried a single 2,205-lb. SC 1000 general-purpose bomb or armour-piercing 3,086-lb. PC 1400 bomb. The racks beneath the outer wing panels could each take a single 551-lb. SC 250 or 1,102-lb. SC 500 bomb, or a pair of 110-lb. SC 50 bombs, but when used by the *Schlachtflieger* the outboard racks were usually occupied by *Waffenbehälter* or weapon containers, such as the WB 81 containing six 7.9-mm. MG 81 machine guns and their ammunition, an alternative *Waffenbehälter* housing a pair of 20-mm. MG FF cannon.





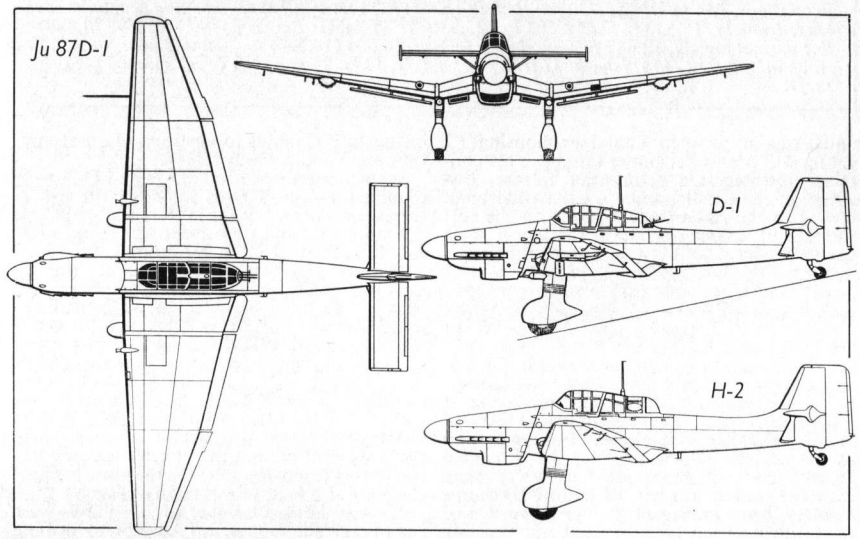
(Above) A Ju 87D-1 with 66 Imp. gal. auxiliary tanks, and (left) a WB 81 container for MG 81 machine guns beneath a Ju 87D-1 wing.

By the late spring of 1941, the Ju 87D-1 had begun to supplant the Ju 87B-2 on the "Weser" assembly lines, but, although offering a major improvement in capability, it was considered as nothing more than an interim type for use pending the availability of higher-performance aircraft. Indeed, production was already in process of tapering off, and whereas 70 Ju 87s were accepted by the *Luftwaffe* in January 1941, only 12 were delivered during the following September and merely two in November.

At this stage full production was suddenly reinstated as an emergency measure, output rising sharply from January 1942, the Bremen factory of "Weser" being phased in from October to augment production at Berlin-Tempelhof, and the total deliveries of 476 aircraft in 1941 were almost doubled in 1942 when 917 aircraft were accepted. The decision to reinstate the Ju 87 resulted primarily from the realization of the fact that no adequate replacement type was likely to be available in quantity for some considerable time, and that, despite its obsolescence and the proven foolhardiness of operating it in areas where air superiority could not be maintained, the continued usefulness of the Ju 87 in many theatres of war could not be denied.

The Ju 87D-1 appeared on the Eastern Front and in North Africa (as the **Ju 87D-1/Trop**) almost simultaneously early in 1942, and the *Stukagruppen* progressively converted from the older Ju 87B-2 throughout the spring and summer. Interspersed with the Ju 87D-1 on the assembly lines was the **Ju 87D-2** which differed solely in having some reinforcement of the rear fuselage and a strengthened tailwheel leg incorporating a towing hook for cargo gliders, this variant being employed principally in North Africa and the Mediterranean theatre, but with growing fighter opposition on all fronts, the operation of dive-bombers was becoming ever more hazardous, and by the end of 1942, the Ju 87D-1 and D-2 had given place on the assembly lines to the first model intended primarily as a *Schlachtflugzeug*, the **Ju 87D-3**.

The Ju 87D-3 embodied increased armour protection for the engine, radiator and crew, but was otherwise similar to the Ju 87D-1 and retained dive brakes. The three Rumanian *Staffeln* that had been operating the Ju 87B-2 in Russia in concert with the *Luftwaffe*'s *Stukagruppen* also re-equipped with the Ju 87D-3 for the close support role, and a weapon widely used by both German and Rumanian



JUNKERS JU 87D-1 SPECIFICATION
(Data in parentheses relates to Ju 87D-7)

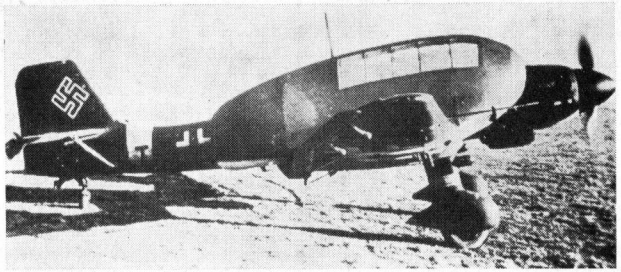
Type: *Two-seat Dive-Bomber and Close-Support Aircraft.* **Power Plant:** *One Junkers Jumo 211J-1 (211P) 12-cylinder liquid-cooled engine rated at* 1,400 (1,500) *h.p. for take-off and* 1,410 *h.p. at* 14,100 *ft.* **Armament:** *Two fixed forward-firing* 7.9-*mm. MG* 17 *machine guns (two* 20-*mm. MG* 151 *cannon) and two* 7.9-*mm. MG* 81 *machine guns on flexible mounting in rear cockpit. (Offensive) One* 3,968-*lb. (short-range overload condition),* 2,205-*lb.,* 1,102-*lb. or* 551-*lb. bomb beneath fuselage, and (with maximum under-fuselage load of* 1,102 *lb.) four* 110-*lb. or two* 551-*lb. bombs, or two packs each containing six* 7.9-*mm. MG* 81 *machine guns or two* 20-*mm. MG FF cannon, or two packs of* 92 4.4-*lb. anti-personnel bombs.* **Performance:** *Maximum speed at* 12,600 (12,782) *lb.,* 255 (248) *m.p.h. at* 13,500 (15,430) *ft.; normal cruising speed at* 72 *per cent power,* 198 (187) *m.p.h. at* 16,700 *ft.; economical cruising speed with* 3,968-*lb. offensive load,* 115 *m.p.h.; normal range,* 510 *mls. at* 13,500 *ft.; maximum range,* 954 *mls. at* 16,730 *ft.; time to* 16,400 *ft.,* 19.8 *min.; service ceiling at maximum loaded weight,* 15,520 *ft., at* 12,600 *lb.,* 23,950 *ft.* **Weights:** *Empty equipped,* 8,598 (8,683) *lb.; normal loaded,* 12,880 *lb.; maximum loaded,* 14,550 (14,565) *lb.* **Dimensions:** *Span,* 45 *ft.* 3⅛ *in.* (49 *ft.* 2½ *in.); length,* 37 *ft.* 8¾ *in.; height,* 12 *ft.* 9¼ *in.; wing area,* 343.368 (362.6) *sq. ft.*

units was a wooden container housing 92 4.4-lb. SC 2 anti-personnel bombs. This container disintegrated soon after release, distributing the small bombs over a wide area. Owing to the risk of nosing over on the soft surfaces of Russian airfields, the wheel spats were frequently removed, and some time later, in 1944, a Ju 87D-3 participated in a series of intriguing experiments with overwing personnel containers. These experiments, which took place at the *Forschungsanstalt Graf Zeppelin* at Stuttgart, involved the use of two pods each accommodating two persons seated in tandem and attached to the upper wing surfaces outboard of the main undercarriage members. It was proposed that the pods should be released in a shallow dive, being lowered to the ground by parachutes which were to be streamed automatically as the pods parted company with the parent aircraft. The Ju 87D-3 *was* flown with the pods, but there is no record of these having been released in flight, possibly owing to difficulties in ensuring clean separation and simultaneous release.

A small number of Ju 87D-1s and D-3s were modified as **Ju 87D-4s** intended for use as torpedo carriers, but these were not employed operationally, and were eventually reconverted as Ju 87D-3s. In the meantime, the ever-increasing operational loads that the Ju 87D was being called upon to carry were resulting in dangerously high wing loadings. In consequence, early in 1943, the **Ju 87D-5** made its début, this featuring extended outer wing panels increasing overall span from 45 ft. 3⅛ in. to 49 ft. 2½ in. The Ju 87D-5 also reintroduced the jettisonable main undercarriage members first fitted to the Ju 87C-0, and although the first production series retained the wing dive brakes, the aircraft was, by this time being employed solely in the close support role, and this feature was soon omitted.

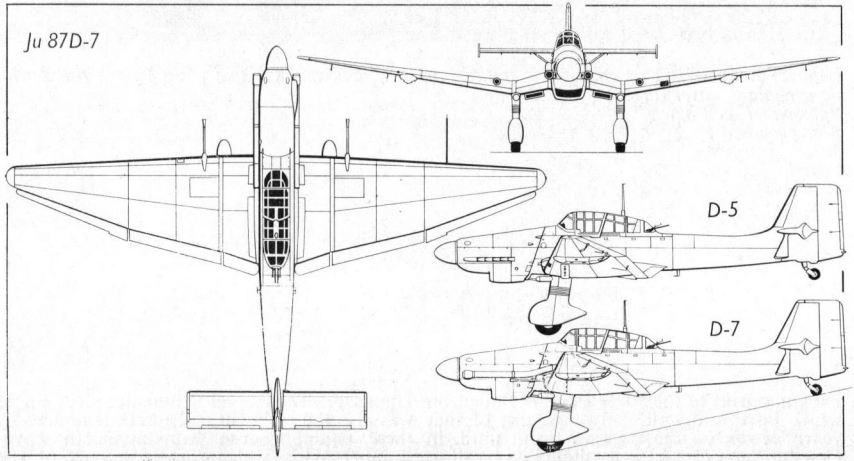
Early in 1943, a number of Ju 87D-5s were supplied to the Hungarian Air Force, forming

(Above) A Ju 87D-1 of St.G.51 over the Soviet Union, and (below) a Ju 87D-3 fitted with detachable overwing "personnel containers" first proposed by Dipl.-Ing. Isermann and tested by the Forschungsanstalt Graf Zeppelin at Stuttgart-Ruit.



the equipment of the 102/1 Bomber Squadron which became operational in August of that year, serving on the Russian Front until, in October, heavy losses necessitated its recall to Hungary. The Royal Rumanian Air Force was also the recipient of Ju 87D-1s and D-5s, these equipping the Rumanian 6th Dive-Bomber Wing which formed a part of the

(Above) A Ju 87D-3 of the Royal Rumanian Air Force's 1st Air Corps in Russia.



Luftwaffe's I *Fliegerkorps* in Russia, and the 3rd Dive-Bomber Wing which was included in the Royal Rumanian 1st Air Corps. The Ju 87Ds of the latter unit were eventually to become the only examples of the Junkers dive-bomber to be employed *against* German forces. At the beginning of September 1944, following the Rumanian *coup d'état* which accompanied the Soviet offensive across the River Pruth, the Ju 87Ds of the 3rd Dive-Bomber Wing, in concert with other units of the Rumanian 1st Air Corps, participated in the fighting around Klausenburg in support of the *Russian* forces.

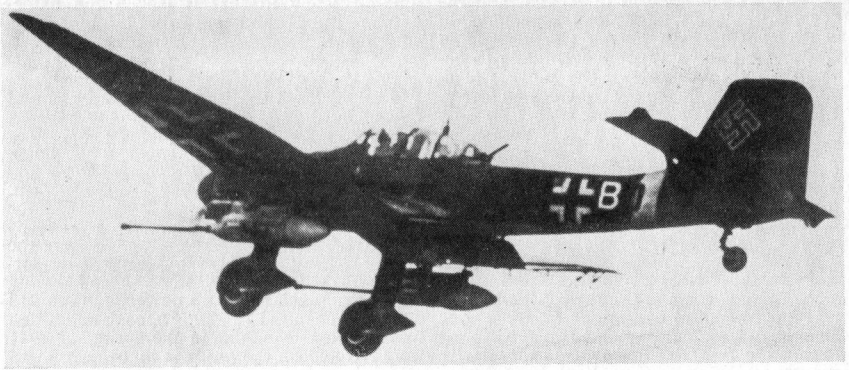
By the spring of 1943, the decimated and overworked *Stukagruppen* were encountering ever-increasing Russian fighter opposition which forced them to restrict themselves largely to nocturnal operations or areas over which the *Luftwaffe* still retained air superiority and thus the **Ju 87D-7** was evolved specifically for nocturnal assault tasks. With large flame-damper tubes leading the exhaust back over the wing, and special night-flying equipment, the Ju 87D-7 was powered by the Jumo 211P which, with increased boost pressure and operating at higher r.p.m., provided 1,500 h.p. for take-off and emergency and 1,410 h.p. at 14,100 ft. The fixed forward-firing 7.9-mm. MG 17 wing guns were replaced by 20-mm. MG 151 cannon, the jettisonable undercarriage of the D-5 was retained, and no dive brakes were fitted.

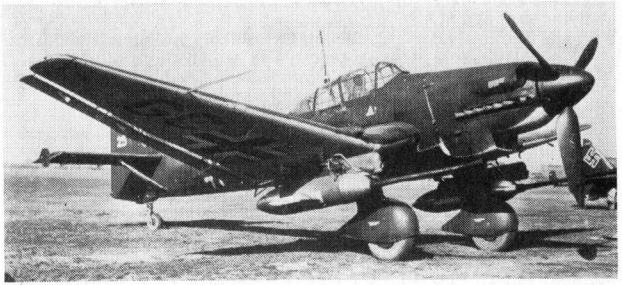
Throughout this time, production of the Ju 87 had been increasing in leaps and bounds, a total of 1,844 being delivered in 1943, peak monthly production being attained in March when 192 aircraft were accepted, but by the early summer of 1944, production was finally tapering off, terminating at last in September of that year when more than 5,700 Ju 87s of all versions had been manufactured. The final production version of the aircraft, the **Ju 87D-8**, which was built in parallel with the Ju 87D-7, differed solely in that it lacked the flame-damper tubes and specialized night-flying equipment.

JUNKERS JU 87F

From mid-1940, the Junkers design bureau at Dessau devoted considerable effort to evolving a modern successor for the Ju 87. The *Technische Amt* of the RLM was demanding a substantial increase in offensive capability coupled with improved defensive armament. Initial studies were commenced under the designation **Ju 87F**, this being broadly based upon the Ju 87D airframe but envisaging the use of a substantially strengthened undercarriage with oversize tyres, an extended wing and the appreciably more powerful Jumo 213 engine. The initial Ju 87F proposals submitted to the *Technische Amt* in the spring of 1941 were rejected on the grounds that they offered an inadequate improvement over the existing Ju 87D, and increased performance was requested.

At this stage, Junkers initiated a more extensive redesign in which more attention was given to aerodynamic cleanliness. The wing was redesigned and, while retaining the characteristic inverted-gull configuration featured by all versions of the Ju 87, adopted a simplified planform, continuous taper being applied to both leading and trailing edges, and the span of the centre section was increased. Simultaneously, a fully-retractable undercarriage was introduced, the main members swivelling through 90° and retracting aft into wing wells. At this juncture, it was realized that the Ju 87F bore little more than a family resemblance to the basic Ju 87, and the RLM allocated the designation **Ju 187** to the project, which, in its final form submitted to the RLM early in 1943, envisaged the use of a Jumo 213A engine rated at 1,776 h.p. for take-off and 1,480 h.p. for climb and combat at 18,500 ft., and





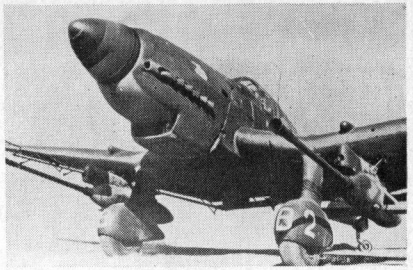
(Above and left) The Ju 87G-1 tank-buster extensively used on the Eastern Front.

featured a remotely-controlled dorsal barbette mounting one 13-mm. MG 131 machine gun and one 20-mm. MG 151 cannon. Fixed forward-firing armament comprised two 20-mm. MG 151 cannon, and maximum offensive load consisted of a 2,205-lb. bomb beneath the fuselage and four 551-lb. bombs on underwing racks. However, it was anticipated that maximum speed with external load would barely exceed 248 m.p.h., and the Ju 187 project was finally abandoned in the autumn of 1943.

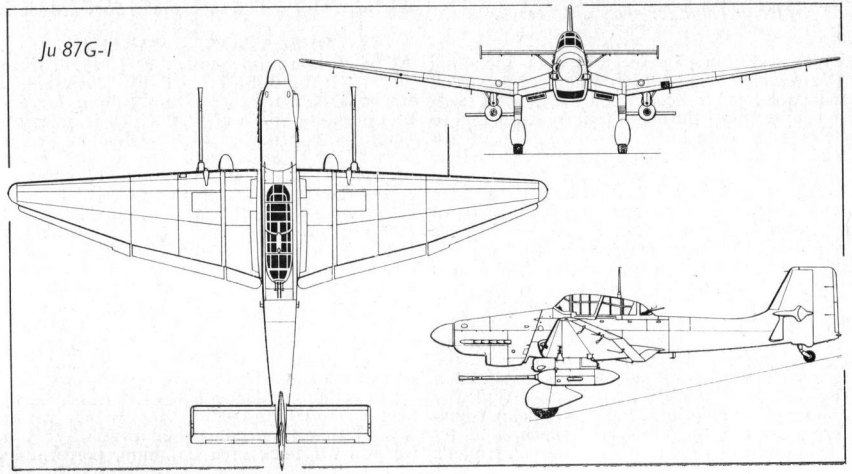
JUNKERS JU 87G

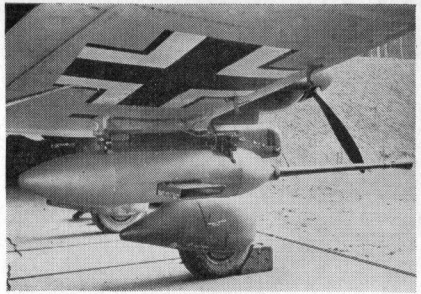
During 1942, the inadequacy of bombs against tanks became increasingly obvious to the *Stukagruppen*. This inadequacy had been revealed, in fact, on the fourth day of the invasion of the Soviet Union when the whole of St.G.2 attacked a concentration of some 60 Soviet tanks 50 miles South of Grodno, later discovering that only one tank had been knocked out, and it was not until the beginning of 1943 that a reasonably satisfactory weapon became available in the form of the first tank-busting Ju 87Gs.

The **Ju 87G-1** was actually a conversion of the Ju 87D-5 to carry a pair of 37-mm. *Flak* 18 (BK 3,7) cannon which, together with their magazines, were slung beneath the wing immediately outboard of the main undercarriage members. The cannon mountings were detachable and could be replaced by bomb racks when there were no tank targets. The installation was first tested operationally in the summer of 1942 on a modified Ju 87D-3



A close-up photograph of a Ju 87G-1 about to take-off for an operational sortie.





The 37-mm. BK 3.7 cannon beneath the starboard wing of a Ju 87G-1. Note protruding ejector chute for spent shell cases.

which was flown by several pilots, including *Oberleutnant* Hans-Ulrich Rudel of 1./St.G.2 who was later to become the *Luftwaffe*'s leading exponent of the art of tank-busting, and to be credited with knocking out a total of 519 Soviet tanks while flying the Ju 87G-1. The brilliant success enjoyed by the *Panzer-Jäger Staffel* formed on the first Ju 87G-1s to reach the Eastern Front resulted, after October 1943 when the *Stukageschwader* 1, 2, 3, and 77 were redesignated *Schlachtgeschwader* 1, 2, 3 and 77, in a Ju 87G-equipped *Panzer-Jäger Staffel* being added to each *Geschwader*.

The Ju 87G-1 suffered the major disadvantage of being extremely slow and unwieldy, and relatively easy prey for fighters, and as Soviet fighter opposition increased, the elderly Junkers was progressively supplanted in the *Schlachtgeschwader* by the Focke-Wulf Fw 190 for day operations, the Ju 87s being transferred to the *Nachtschlachtgruppen*, and by the autumn of 1944 only one *Gruppe*, Rudel's III/SG 2, was still on daylight operations with the Ju 87D and G, together with two anti-tank *Staffeln*, 10.(Pz)/SG 2 and 10.(Pz)/SG 77.

JUNKERS JU 87H

From 1943, a number of standard Ju 87Ds were converted as dual-control trainers under the designation Ju 87H to aid in the conversion of former fighter and bomber pilots to fill the personnel ranks of the *Schlachtgruppen* suffering heavy losses on the Eastern Front. The **Ju 87H-1**, **H-3**, **H-5**, **H-7** and **H-8** were dual-control conversions of the corresponding D-series models, and apart from the installation of dual controls and the removal of weapon racks and gun armament, the conversion included the provision of a new rear cockpit canopy with glazed lateral blisters to provide the instructor with a measure of forward view.

OPERATIONAL CAREER

At 04.26 hours on September 1, 1939, three Ju 87B-1s of 3./St.G.1 led by *Oberleutnant* Bruno Dilley took off from Elbing for the first bombing sortie of W.W.II, their objective being the approaches to the Dirschau bridge across the Vistula, and the attack being pressed home at 04.34 hours, 11 minutes *before* the official declaration of war. For the attack on Poland, the *Luftwaffe* had deployed all nine of its *Stukagruppen*, the *Lehr-Division*'s IV(St.)/LG 1 and *Luftflotte* 1's I/St.G.1 and II and III/St.G.2, together with the 4.(St)/*Trägergruppe* 186, operating in the North, and *Luftflotte* 3's III/St.G.51 and *Luftflotte* 4's I/St.G.76 and I and II/St.G.77, together with I/St.G.2 detached from *Luftflotte* 1, operating in the South, aircraft strength totalling 348 machines of which 300 were operational.

Operating under ideal conditions, with neglible aerial opposition, the Ju 87, which was at that time considered primarily as a weapon for back area bombing, performing

"softening up" attacks on communications and vital rear areas, was continuously engaged in attacking Polish airfields, naval installations, bridges, road and rail junctions and other strategic targets, exploiting to the full the accuracy of bomb aiming inherent in the steep diving attack. A total of 31 Ju 87Bs was lost to enemy fighter activity or anti-aircraft fire, or approximately 10 per cent of the total *Stuka* force, and a legendary reputation had been established.

Only one *Stukagruppe*, I/St.G.1 equipped with the Ju 87R-1, participated in the invasion of Denmark and Norway, initially operating from Kiel-Holtenau and performing its first mission against fortified positions at Oskarsborg and Akershus on April 10, 1940, but before the Norwegian campaign had finally terminated, the invasion of France and the Low Countries had begun, and the bulk of the *Stukagruppen* had been concentrated under the control of *Generalleutnant* Wolfram von Richthofen's VIII *Fliegerkorps*. On May 10, 1940, this *Fliegerkorps* had available the *Stab*, I and III/St.G.2 to which I/St.G.76 had been attached, and the *Stab*, I and II/St.G.77 to which IV(St)/LG 1 was attached, and after initial support of the Meuse crossings, these *Stukagruppen* co-operated closely with the *Panzer* units, attacking troop concentrations and strongpoints in the path of their advance. After only two days, the VIII *Fliegerkorps* was transferred from *Luftflotte* 2 to *Luftflotte* 3 to assist in the push through Luxembourg and the Ardennes, and despite the intensity of operations, attrition was relatively low, only 14 Ju 87s being lost during the opening four days of the campaign.

Within two weeks, the *Stukagruppen* were attacking Boulogne and other Channel ports, with special emphasis on Dunkirk, and on June 5th, the day after British forces completed their evacuation from Dunkirk, were transferred southwards for operations East of Paris, assisting in the crossings of the Marne, the Seine and the Loire. By June 24th, two-thirds of the VIII *Fliegerkorps* had been pulled back to Normandy in preparation for attacks on Channel shipping, the *Stukagruppen* being dispersed at airfields on the Cherbourg Peninsula.

On July 6th, the *Luftwaffe* was regrouped in preparation for *Adlertag* which was to mark the commencement of the onslaught on Britain, some of the *Stukagruppen* being redesignated to raise the existing Ju 87-equipped *Geschwader* to full three-*Gruppen* strength, and a new *Stukagruppe*, I/St.G.3, being formed. The original shipboard unit, 4.(St)/Tr.Gr.186 which had been brought up to full *Gruppe* strength during the Polish campaign, now became III/St.G.1, III/St.G.77 being redesignated II/St.G.1, and I/St.G.76 becoming III/St.G.77.

By August 13th, 280 Ju 87s were poised for the assault on Britain, these belonging to III/St.G.1 and IV(St)/LG 1 under the II *Fliegerkorps*, and the *Stab*, I and III/St.G.1, the *Stab*, I and II/St.G.2, and the *Stab*, I, II and III/St.G.77 under the VIII *Fliegerkorps*. Within little more than two weeks it had become obvious that the Ju 87 was not to emulate its previous successes. Forty Ju 87s had been lost and the *Stuka* had been revealed for what it was: a poorly armed, somewhat cumbersome and highly vulnerable aircraft.

To prevent the *Stukagruppen* from being decimated, the Ob.d.L. was forced to withdraw them from the Cherbourg area to the Pas de Calais where they were to sit out the closing stages of the "Battle of Britain", the last *Stuka* sortie in force against British targets taking place on August 30th when II/St.G.1 and II/St.G.2, together with I/St.G.3 which had now joined combat, made an attack on fighter fields in South-East England.

Virtual redundancy in the West did not mean the end of the Ju 87's operational career for, despite the fact that the *Luftwaffe* was now split into pro- and anti-*Stuka* factions, it still retained much of its réclame, and it was to enjoy several more noteworthy successes before its role of hunter finally gave place to that of the hunted. From the beginning of 1941, several *Stukagruppen* were transferred to the Mediterranean, I/St.G.1 and II/St.G.2, together with the *Stab* flight of St.G.3, arriving at Trapani, Sicily, early in January for attacks on convoys plying between Gibraltar, Malta and Alexandria. On January 10th, Ju 87s from I/St.G.1 and II/St.G.2 attacked and seriously damaged the carrier *Illustrious*, and on the following day, II/St.G.2 attacked and sank the cruiser *Southampton*. The two *Stukagruppen* were quickly augmented in the strength of the X *Fliegerkorps* in Sicily and North Africa by the *Stab* and II and III/St.G.1, while von Richthofen's VIII *Fliegerkorps* was preparing for the onslaught on the Balkans for which the *Stab*, I and III/St.G.2 and I/St.G.3 were transferred from France.

Including the aircraft of *Stukagruppen* detached from the X *Fliegerkorps*, von Richthofen's VIII *Fliegerkorps* mustered 414 Ju 87s of which, on April 5, 1941, 352 were serviceable, and these were later augmented by the 127 Ju 87s of St.G.77's three *Gruppen*. With the successful completion of the Yugoslavian and Greek campaigns in which the *Luftwaffe* had enjoyed complete mastery in the air, providing the *Stukagruppen* with the ideal operating conditions that, from their viewpoint, were so sadly lacking over Britain, the VIII *Fliegerkorps* turned its attention to the reduction of Crete, operating from the Peloponnesean airfields of Molae and Mycenae.

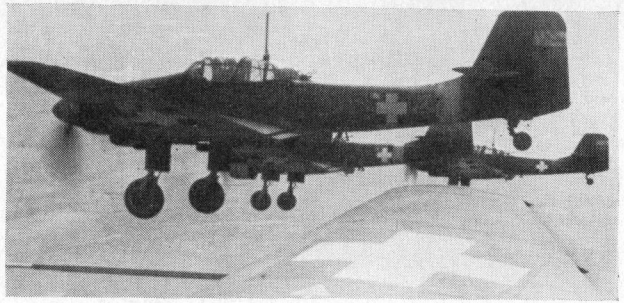
It was during the assault on Crete that the Ju 87 achieved one of the most spectacular successes of its career, the three *Gruppen* of St.G.2 flying from Molae and Mycenae, and from the island of Scarpanto, between Crete

Ju 87B-2 of the 239a Squadriglia, 10o Gruppo Tuffatori, formed in February 1941 and subsequently active in Albania and Sicily.

and Rhodes, participating in the sinking of the cruiser *Gloucester*, sending several destroyers, including the *Greyhound*, the *Kelly* and the *Kashmir*, to the bottom, and severely damaging numerous other British naval vessels, including the carrier *Formidable*.

For the commencement of Operation *Barbarossa*, the invasion of the Soviet Union in June 1941, the wholesale transfer of *Stukagruppen* from the Balkans and Mediterranean had taken place, and participating in the opening phases of the campaign were *Stab*, II and III/St.G.1 with 77 aircraft of which 57 were serviceable, and *Stab* I and III/St.G.2 with 83 aircraft of which only 46 were serviceable, these units being attached to the VIII *Fliegerkorps*, and the *Stab*, I, II and III/St.G. 77, with 122 aircraft of which 94 were serviceable, attached to the II *Fliegerkorps*, all seven *Gruppen* being sub-ordinated *Luftflotte* 2 on the Central Sector of the front. In addition, IV(St)/LG 1 with 42 Ju 87s (36 serviceable) was based in northern Norway with *Luftflotte* 5.

The Russian campaign at first proved a repetition of the French debacle, and the *Stukagruppen* once again roamed freely over enemy territory, being transferred from one sector of the front to another as the tactical situation demanded. Among noteworthy successes during the opening months of the campaign in the East were I and III/St.G.2's operations against the Soviet Baltic Fleet at Kronstadt and Leningrad. On September 23, 1941, these *Gruppen*, based on Tyrkovo, attacked the battleships *October Revolution* and *Marat* at Kronstadt, the latter vessel breaking her back and sinking, the decisive hit being credited to *Oberleutnant* Hans-Ulrich Rudel who was to become the Ju 87's staunchest advocate, flying this ageing type well after the remainder of his *Geschwader* had converted to the Fw 190.



Ju 87D-5s and Ju 87B-2s of the Hungarian 102/1 Dive-Bomber Squadron which saw considerable service over the Eastern Front.

In the meantime, *Luftflotte* 2 had been transferred to the Mediterranean with the two aims of driving the Allies from North Africa and neutralizing Malta. At its disposal was St.G.3, which had been brought up to full three-*Gruppen* strength, and the *Ergänzungs-Gruppe* of St.G.1. Operating mainly in North Africa at a time when opposition was still spread thinly on the ground, the *Stukagruppen* gave invaluable support to the *Afrika Korps*, highlights in their activities including the bombing of Tobruk and, in June 1942, their contribution to the capture of the fortress of Bir Hacheim

One of the last D-series production models, the Ju 87D-7 (above) was evolved specifically for nocturnal assault tasks, and featured 20-mm. cannon armament.

from the Free French. By mid-1942, by which time St.G.3 was in process of converting from the Ju 87B-2/Trop to the Ju 87D-1/Trop, Allied air power was beginning to gain strength, a fact which, coupled with fuel shortages, led to a progressive reduction in the Ju 87's usefulness, and by the time of the Tunisian evacuation, the surviving Ju 87s had been withdrawn to Italy.

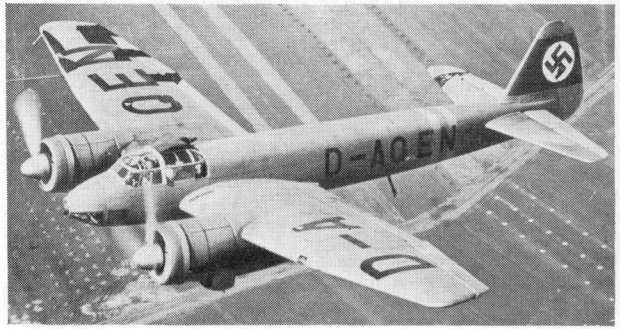
In the Far North, the IV(St)LG 1 had been redesignated I/St.G.5 and was operating along the Murmansk railway, but by the end of 1942, the *Stukagruppen* on the Eastern Front were having difficulty in maintaining a semblance of operational strength in the face of growing Soviet opposition, and at the beginning of 1943, the first *Stukagruppe* converted to the Fw 190. By October 1943, when the designation *Stukageschwader* was abandoned in favour of *Schlachtgeschwader*, the Ju 87-equipped *Gruppen* were converting to the Fw 190 at the rate of about two *Gruppen* every six weeks. The Ju 87s thus made available were fed into the newly-formed *Nachtschlachtgruppen* for nocturnal assault operations, and by the autumn of 1944, only one Ju 87 *Gruppe*, Rudel's III/SG 2 (formerly III/St.G.2), was still undertaking daylight sorties on the Eastern Front.

On August 24, 1944, I/SG 2, equipped with Fw 190s and based at Zilistea with the Rumanian 6th Dive-Bomber Wing, took over the Ju 87Ds of the Rumanian unit during the disarming operation and, lacking 95 octane fuel for its Fw 190s, employed the sequestered Ju 87Ds against targets in and around Bucharest.

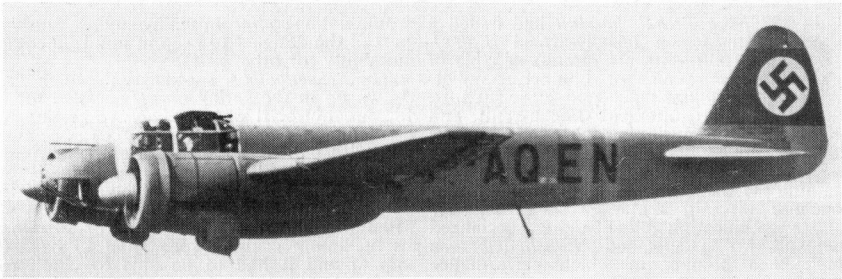
Some of the Ju 87s were relegated to the glider-towing role, but the Ju 87D soldiered on into the closing months of the war with *Nachtschlachtgruppen* 1, 2, 4, 9 and 10, while the Ju 87G-1 served with the specialized anti-tank *Staffeln*, such as 10.(Pz)/SG 2 and 10.(Pz)/SG 77.

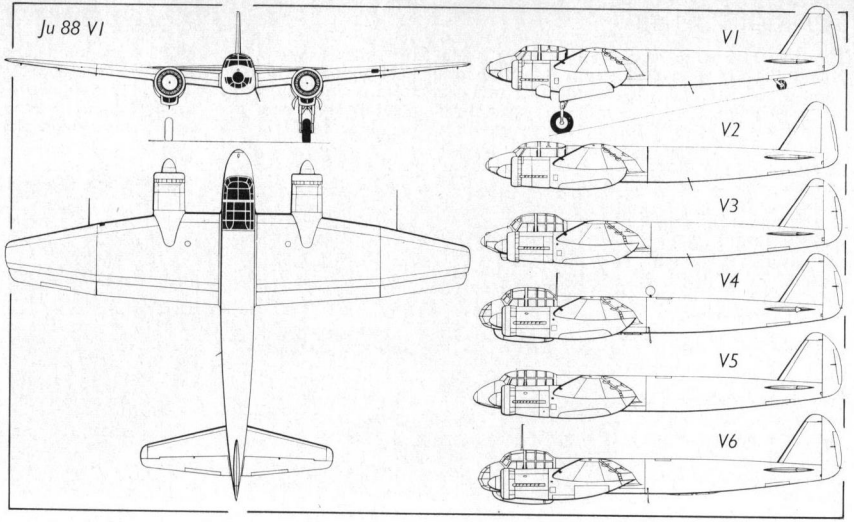
JUNKERS JU 88 — GERMANY

The Ju 88 is widely believed to have exemplified the German philosophy of using one good basic airframe for a multitude of tasks rather than evolving a variety of specialized machines and thus complicating production. This belief is, however, a misleading simplification of the facts, for the supreme amenability to the process of adaptation and modification to which the aircraft was submitted, and which was to result in this ubiquitous warplane being considered the backbone of the *Luftwaffe*, was purely fortuitous and the result of no remarkable foresight on the part of the RLM's *Technische Amt* which framed the specification to which the Ju 88 was designed.



(Right and below) The Ju 88 V1 (D-AQEN). Note test camera housing with aft-facing camera above the cockpit canopy.





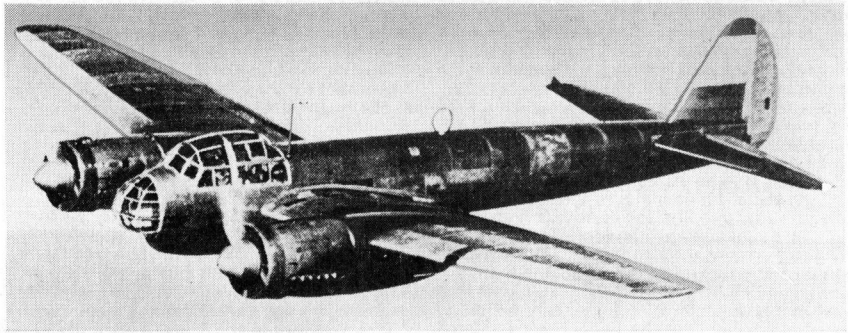
In 1934, the *Technische Amt* had issued a specification for a heavily-armed *Kampfzerstörer*, a multi-purpose aircraft capable of performing the roles of bomber, bomber-destroyer, reconnaissance and close-support, and to this requirement Focke-Wulf and Henschel were developing the Fw 57 and Hs 124 respectively. By the beginning of 1935, the RLM had begun to experience doubts concerning the wisdom of developing such multi-purpose aircraft, replacing the *Kampfzerstörer* specification by a more specialized demand for a so-called *Schnellbomber*—a high-speed bomber in which performance would not be compromised by any need on the part of the designer to keep in mind potential suitability for other roles.

The *Schnellbomber* specification, which was drawn up in the spring of 1935, called for a three-seat aircraft with a defensive armament consisting of a single 7.9-mm. MG 15 machine gun with 500 rounds in the dorsal position, and normal and maximum bomb loads of 1,100 and 1,765 lb. respectively. It had to be capable of attaining a maximum speed of 310 m.p.h. and maintaining this for 30 min.; its maximum cruising speed had to be 280 m.p.h., and it had to be able to climb to

22,965 ft. with normal bomb load within 25 min. It had to be capable of taking-off in normal loaded condition and clearing a 65-ft. obstacle within 765 yards, and its landing run with 50 per cent of its disposable load was not to exceed 440 yards.

The specification was issued to Focke-Wulf, Henschel, Junkers and Messerschmitt, and it was stated that production orders would be placed only after comparative tests between contending designs. Focke-Wulf declined to join the competition, but both Henschel and Junkers initiated designs intended to fulfil the

(Right) The Ju 88 V3 (D-ASAZ), the first Jumo-engined prototype, and (below) the Ju 88 V4 with production-type nose.



requirements of the new specification, and Messerschmitt began work on a design based broadly on the Bf 110 *Zerstörer*.

Junkers, anxious to embody the latest structural techniques in its *Schnellbomber* contender, recruited for the task of designing the bomber W. H. Evers and A. Gassner, both having gained considerable experience in light metal stressed-skin constructional methods in the U.S.A., it being stipulated that the prototype be completed within nine months and that the series production version must demand no more than 30,000 man-hours per aircraft. Work began on the project at Dessau on January 15, 1936, and initially two parallel project studies were made, these envisaging basically similar aircraft, but one, designated **Ju 85** by the RLM, featured a twin fin-and-rudder tail assembly, and the other, designated **Ju 88**, having a single fin-and-rudder assembly. Some delay resulted while the *Technische Amt* considered the merits of the alternative proposals, but the Ju 88 was finally selected, and in May 1936 the first metal was cut on three prototypes, the first of these, the **Ju 88 V1** (D-AQEN), being completed in 105,000 man-hours and flying for the first time on December 21, 1936 with Junkers' chief test pilot, *Flugkapitän* Kindermann, at the controls.

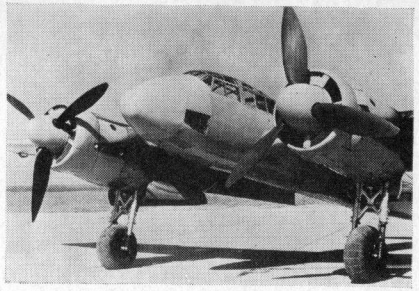
A low-wing cantilever monoplane powered by two Daimler-Benz DB 600Aa 12-cylinder liquid-cooled engines with annular radiators and rated at 1,000 h.p. for take-off and 910 h.p. at 13,120 ft., the Ju 88 V1 featured an oval-section metal monocoque fuselage built up of Z-section frames and top hat-section stringers to which was riveted a smooth stressed skin. The two-spar wings also featured flush-riveted stressed-skin covering, and the main undercarriage members were electrically operated and employed twin oleo legs. Only a limited amount of flight testing had been completed when the Ju 88 V1 was lost in an accident, but on April 10, 1937, the **Ju 88 V2** (D-AREN) began its flight-test programme. Like its predecessor, the Ju 88 V2 was powered by DB 600Aa engines, and differed externally from the V1 only in having the small radiator scoops removed from beneath the engines, but the **Ju 88 V3** (D-ASAZ) switched to Junkers Jumo 211A engines rated at 1,000 h.p. for take-off and offering 975 h.p. at 13,780 ft. The cabin roof was raised and provision made for an aft-firing 7.9-mm. MG 15 machine gun, and a bomb sight was housed in a blister beneath the starboard side of the nose.

The Ju 88 V3 flew on September 13, 1937, and was officially evaluated at the *Erprobungsstelle* at Rechlin where it dispiayed something of the qualities that were to render its production derivatives so valuable to the *Luftwaffe*. The Ju 88 V3 attained a maximum speed of 323 m.p.h. as compared with the 289 m.p.h. attained by the DB 600-powered V2, and possessed a loaded weight of 18,740 lb., and so enthusiastic were the reports of the *E-Stelle* pilots that the RLM instructed Junkers to proceed with the construction of three additional prototypes before competitive evaluation with the two other contenders for production orders, the Henschel Hs 127 and the Messerschmitt Bf 162. In the event, delays in the commencement of flight testing of Henschel's offering and an RLM decision that Messerschmitt should concentrate on fighter development left the field free for the Ju 88, and the Junkers concern was asked to submit its proposals for large-scale dispersed production.

As a result of these proposals, the Junkers-Werke at Schönebeck began the manufacture of production tools and jigs in the spring of 1938, the Junkers-Werke Aschersleben was designated as the centre for the manufacture of fuselages, while the wings and tail assemblies were to be produced at the Junkers factories at Halberstadt and Leopoldshall respectively, with the final assembly and flight testing to be carried out at Bernburg. Shortly afterwards, the RLM placed orders for the supply of components and complete aircraft with Arado at Brandenburg, Heinkel at Oranienburg, Henschel at Schönefeld, Dornier at Wismar and the Volkswagen-Werke at Wolfsburg.

Meanwhile, the *Technische Amt* had modified its specification to incorporate dive-bombing capability, increased defensive armament and a fourth crew member, and these changes were embodied by the **Ju 88 V4** which, flown on February 2, 1938, introduced a "beetle's eye" of optically-flat panels in the nose and a ventral cupola terminating in a position for a single 7.9-mm. aft-firing gun on a flexible mounting.

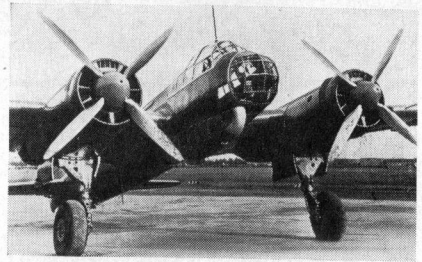
At this time, the German aircraft industry was intent on gaining international prestige, and it was decided that no better way of revealing the new *Schnellbomber* to the world existed than by using it for a record-breaking flight. Therefore, the fifth prototype, the **Ju 88 V5** (D-ATYU), which had flown for the first time on April 13, 1938, was modified for the task. As initially flown, the Ju 88V5 had differed from the V4 solely in having Jumo 211B-1 engines as specified for the production model, these being rated at 1,200 h.p. for take-off and 1,210 h.p. at 820 ft. With the ventral gondola removed, the cabin roof lowered, and a new pointed nose cone fitted, the Ju 88 V5 established a new 621-mile closed-circuit record in March 1939 by carrying a 4,409-lb. payload at an average speed of 321.25 m.p.h., the pilots being Ernst Siebert and Kurt Heintz. Four months later, carrying the same load, the Ju 88 V5 covered a distance of 1,242.7 miles at an average speed of 311 m.p.h. The Ju 88 V5, together with the Ju 88 V2, was later to be employed as a test airframe in the Ju 288 development programme.



The Ju 88 V5 (D-ATYU) after modification for attempts on international speed-with-load records.

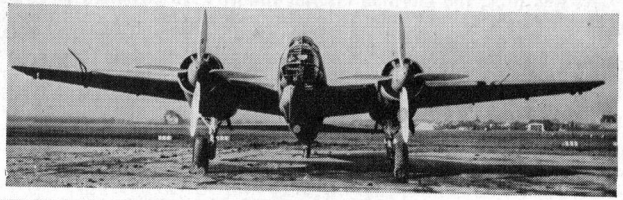
While preparations for these record flights were being made, the **Ju 88 V6** (D-ASCY), the production prototype for the A-series bomber, had joined the test programme, having flown on June 18, 1938, this being followed by four further prototypes which had been ordered, together with 10 pre-production Ju 88A-0 bombers, by the RLM with the final decision to adopt the Junkers type to meet the *Schnellbomber* requirement.

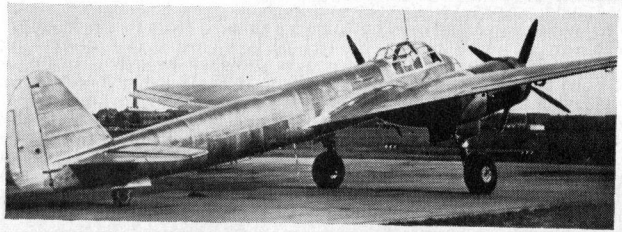
The Ju 88 V6 differed from its predecessors in several respects. Like the record-breaking V5, power was provided by a pair of Jumo 211B-1 engines, but four-blade airscrews supplanted the three-bladers previously used, and the engine nacelles were substantially reduced in depth, this reduction being made possible by the complete redesign of the main undercarriage units, these employing single hydraulically-actuated legs, the wheels turning through a 90 deg. arc to lie flat in the tails of



the nacelles. Like the V4, the V6 was a four-seater, and loaded weight was increased from 22,040 to 22,590 lb. Provision was made for a defensive armament of three 7.9-mm. MG 15 machine guns and an internal bomb load of 1,100 lb.

The **Ju 88 V7**, which flew on September 27, 1938, was the second pre-production prototype for the A-series, some time later being modified as the first *Zerstörer* prototype for the C-series; the **Ju 88 V8** and **V9**, which flew on October 3 and October 31, 1938 respectively, were similar to the V6 and V7 but introduced slatted dive brakes outboard of the engine nacelles, and the **Ju 88 V10**, which flew on February 3, 1939, tested external bomb carriers inboard of the engine nacelles, both dive brakes and bomb carriers being standardized on the **Ju 88A-0** which began to leave the assembly line in March 1939.

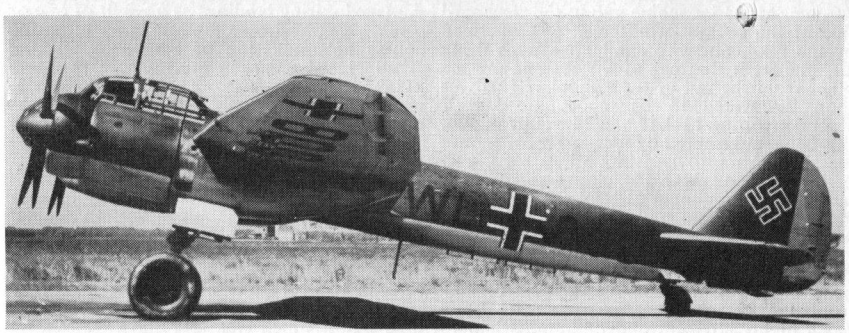




(Immediately above and left) the Ju 88 V6 with original swivelling main-wheel units, and (at head of page) with heavier leg castings.

JUNKERS JU 88A

The Ju 88A-0s were delivered to the specially-formed *Erprobungskommando* 88, the principal tasks of which were those of exhaustively testing the bomber under service conditions and evolving training techniques. This *Erprobungskommando* provided a nucleus for I/KG 25 formed in August to receive the first production Ju 88A-1s, and redesignated I/KG 30 on September 22, 1939, the *Lehrgruppe-Ju* 88 being activated simultaneously at Greifswald to train Ju 88 crews. Deliveries of the **Ju 88A-1** were slower than had been anticipated, and when I/KG 30 performed its first operational sortie on September 26, 1939, it included several of the pre-production Ju 88A-0 bombers on strength.



The pre-production Ju 88A-0 (WL-008 being illustrated above) differed from the production Ju 88A-1 primarily in having four-blade airscrews.

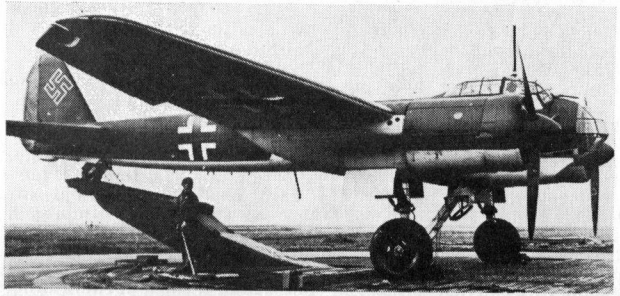
The Ju 88A-1 was essentially similar to the Ju 88A-0, apart from reverting to three-blade airscrews in place of the four-bladers introduced with the Ju 88 V6. Its four crew members were closely grouped in the fuselage nose forward of the front wing spar, the pilot to port with the bombardier below and to starboard, the flight engineer being situated aft of the pilot and facing to the rear, with the radio-operator alongside but lower in the fuselage so that he could squeeze himself into the ventral gondola to operate the lower rear gun. Two internal bomb-bays were provided, these being capable of housing a maximum of 28 110-lb. SC 50 bombs, and two external carriers were fitted beneath each wing, inboard of the engines, these each being capable of lifting a 1,102-lb. bomb but normally carrying 220-lb. bombs when maximum internal bomb load was being carried, providing an offensive bomb load of 3,960 lb. For short-range missions under overload conditions, the external racks could carry four 551-lb. or two 1,102-lb. bombs, raising maximum load to 5,284 lb. A dive-bombing sight was mounted in the cockpit roof, and when not in use could be swung to port so as not to interfere with the field of view.

Standard fuel tankage comprised a 91 Imp. gal. tank outboard and a 93.4 Imp. gal. tank inboard of each engine nacelle, but for extended range missions a 268 Imp. gal. auxiliary tank could be inserted in the forward bomb-bay and, if necessary, a 149.6 Imp. gal. tank in the aft bomb-bay. Initially, defensive armament consisted of a single forward-firing

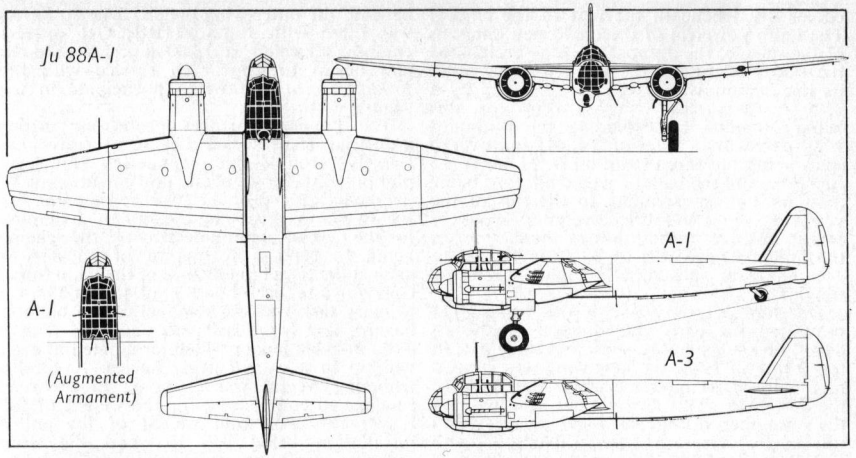
7.9-mm. MG 15 machine gun in the starboard side of the cockpit windscreen and operated by the pilot, and two similar weapons firing aft, one from the rear of the cockpit and the other from the tail of the gondola. This was soon discovered to be inadequate and a second aft-firing MG 15 was hurriedly added, this being augmented by forward maintenance units which improvised mountings for a pair of lateral firing MG 15s. As these weapons had each to be operated independently no great weight of fire could be brought to bear.

Like most new combat aircraft, the Ju 88A-1 suffered its share of teething troubles. For example, the slatted dive brakes hinged beneath the front spar gave considerable trouble when extended, the fuselage already being highly stressed, and limitations had to be imposed on high-speed manoeuvres. All aerobatics were forbidden, and the crews' attention was drawn to the possibility of structural failure if the loading diagram was not strictly adhered to. Another problem encountered initially was provided by the undercarriage, and the first 10 aircraft delivered from Arado's Brandenburg plant were all damaged during landings as a result of one or other mainwheel oleo leg failing. During the course of production of the Ju 88A-1, the Jumo 211B-1 engines were replaced by Jumo 211G-1s of similar power, and with attachment points for assisted take-off rocket packs the designation was changed to **Ju 88A-2**. These packs were intended for use under overload conditions, and were jettisoned after take-off, being lowered to the ground by parachute for retrieval and recharging.

The **Ju 88A-3** was a conversion trainer variant of the Ju 88A-1 with dual controls and throttles, and various instruments duplicated, but the **Ju 88A-4**, development of which began early in 1940, represented the first stage in the lengthy process of modification and improvisation which was to result in an extraordinarily complex development history. Progressive development of the basic Jumo 211 engine had resulted in the appreciably more powerful Jumo 211F and 211J, the principal differences between these and the Jumo 211B and 211G being a strengthened crankshaft, a fully-shrouded DVL supercharger impeller, modified boost control, modified injection pump control, simplified plungers and a pressurized coolant system, the Jumo 211J also having an induction air



An early production Ju 88A-1 on compass-swinging table.



JUNKERS JU 88A-1 SPECIFICATION

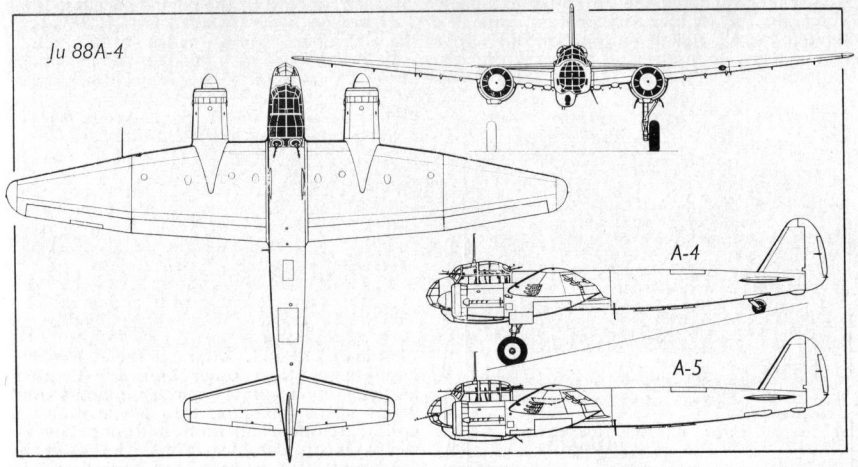
Type: *Four-seat Level- and Dive-Bomber.* **Power Plants:** *Two Junkers Jumo* 211*B*-1 *or G*-1 12-*cylinder liquid-cooled engines each rated at* 1,200 *h.p. for take-off and* 1,210 *h.p. at* 820 *ft.* **Armament:** (*Defensive*) *One fixed or free-mounted forward-firing* 7.9-*mm. MG* 15 *machine gun and two* 7.9-*mm. MG* 15 *machine guns firing aft from flexible mountings above and below the fuselage* (*later augmented by two lateral-firing MG* 15*s*). (*Offensive*) *Maximum of* 28 110-*lb. bombs in two internal bays and four* 220-*lb. bombs externally on ETC racks, or* 10 110-*lb. bombs in aft bay and four* 551-*lb. SC* 250 *or two* 1,102-*lb. SC* 500 *bombs externally.* **Performance:** *Maximum speed* (*at* 19,750 *lb.*), 280 *m.p.h. at* 18,050 *ft.*, 272 *m.p.h. at* 19,685 *ft.*, 227 *m.p.h. at sea level,* (*at* 22,840 *lb.*) 258 *m.p.h. at* 18,050 *ft.; 250 m.p.h. at* 19,685 *ft.; normal cruising speed,* 217 *m.p.h. at* 18,050 *ft.; range* (369 *Imp. gal. fuel*), 620 *mls. at* 217 *m.p.h. at* 18,050 *ft.*, (*with* 268 *Imp. gal. tank in forward bomb-bay*), 1,055 *mls.; maximum ceiling,* 32,150 *ft.; service ceiling* (*at* 19,750 *lb.*), 26,250 *ft.*, (*at* 22,840 *lb.*), 22,700 *ft.* **Weights:** *Empty equipped,* 16,975 *lb.; maximum loaded,* 22,840 *lb.* **Dimensions:** *Span,* 60 *ft.* 3¼ *in.; length,* 47 *ft.* 1⅛ *in.; height,* 17 *ft.* 5¾ *in.; wing area,* 565.1 *sq. ft.*

cooler fitted beneath the rear of the engine. The more powerful of these two new versions of the engine, the Jumo 211J, was designated the power plant for the new Ju 88A-4, and its installation was to be accompanied by a 25.5 sq. ft. increase in gross wing area, this being obtained by extending the outboard wing panels by a total of 5 ft. 4¼ in., overall span being increased from 60 ft. 3¼ in. to 65 ft. 7½ in., and the metal-covered ailerons being inset instead of extending to the tips of the wings as did the fabric-covered ailerons of earlier models. In addition to these changes, the undercarriage was to be strengthened to accommodate substantially higher operating weights.

Development delays with the Jumo 211J prevented the early introduction of the Ju 88A-4 on the assembly lines, and therefore, in the spring of 1940, the new wing was applied to the Ju 88A-1 airframe which thus became the **Ju 88A-5**. This new variant also featured the strengthened undercarriage, and provision was made for two additional external bomb carriers each of 550-lb. capacity and mounted beneath the outer wing panels. The Ju 88A-5 was fitted with Jumo 211B-1, G-1 or H-1 engines, all rated at 1,200 h.p. for take-off, and began to appear in service with the *Kampfgruppen* in time to participate in the "Battle of Britain".

The balloon barrages protecting British industrial centres had begun to prove extremely troublesome, rendering low-level pinpoint attacks difficult, and an attempt to overcome this problem was represented by the **Ju 88A-6**, this being the Ju 88A-5 adapted for the task of balloon destroying, the scheme being to send a formation of Ju 88A-6s against the target in advance of the main force. Carrying a reduced bomb load, the Ju 88A-6's primary task was the removal of the balloon hazard, and for this it was equipped with a balloon-cable fender which terminated at each wingtip in a cable-cutting device. A 130-lb. trimming weight was mounted in the rear fuselage to compensate for the weight of the fender forward, total weight of the entire installation being 840 lb., and the drag reducing maximum cruise speed by 19 m.p.h.

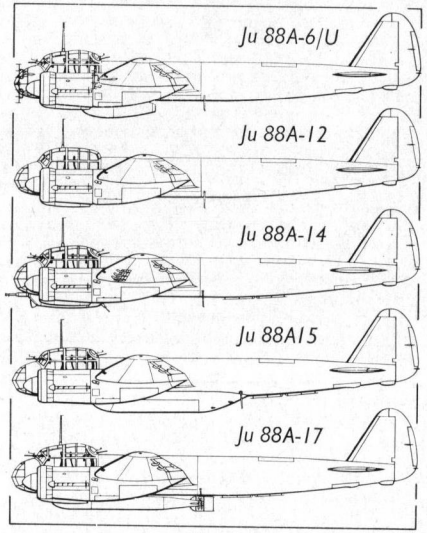
A Ju 88A-5 of I/KG 54 which converted to this type in the early summer of 1940.



JUNKERS JU 88A-4 SPECIFICATION

Type: *Four-seat Level- and Dive-Bomber.* **Power Plants:** *Two Junkers Jumo* 211*J*-1 *or J*-2 12-*cylinder liquid-cooled engines each rated at* 1,340 *h.p. for take-off,* 1,350 *h.p. at* 820 *ft. and* 1,060 *h.p. at* 17,000 *ft.* **Armament:** *One fixed or free-mounted forward-firing* 7.9-*mm. MG* 81 *machine gun, one free-mounted forward-firing* 13-*mm. MG* 131 *or two* 7.9-*mm. MG* 81 *machine guns, two* 7.9-*mm. MG* 81 *machine guns firing aft above the fuselage and one* 13-*mm. MG* 131 *or two* 7.9-*mm. MG* 81 *machine guns firing aft below the fuselage.* (*Offensive*) *Ten* 110-*lb. SC* 50 *bombs internally and four* 551-*lb. SC* 250 *or two* 1,105-*lb. SC* 500 *bombs externally, or four* 1,105-*lb. bombs externally.* **Performance:** *Maximum speed* (*at* 27,557 *lb.*), 292 *m.p.h. at* 17,390 *ft.*, 280 *m.p.h. at* 19,685 *ft.*, (*at* 30,865 *lb.*), 269 *m.p.h. at* 14,765 *ft.; economical cruising speed,* 230 *m.p.h. at* 17,390 *ft.; maximum cruising speed,* 248 *m.p.h. at* 16,405 *ft.; normal range* (*with* 637 *Imp. gal.*), 1,112 *mls.*, (*with* 886 *Imp. gal.*), 1,696 *mls.; climb to* 17,716 *ft.*, 23 *min.; service ceiling,* 26,900 *ft.* **Weights:** *Empty equipped,* 21,737 *lb.; normal loaded,* 26,686 *lb.; maximum loaded,* 30,865 *lb.* **Dimensions:** *Span,* 65 *ft.* 7½ *in.; length,* 47 *ft.* 2⅜ *in.; height,* 15 *ft.* 11 *in.; wing area,* 586.63 *sq. ft.*

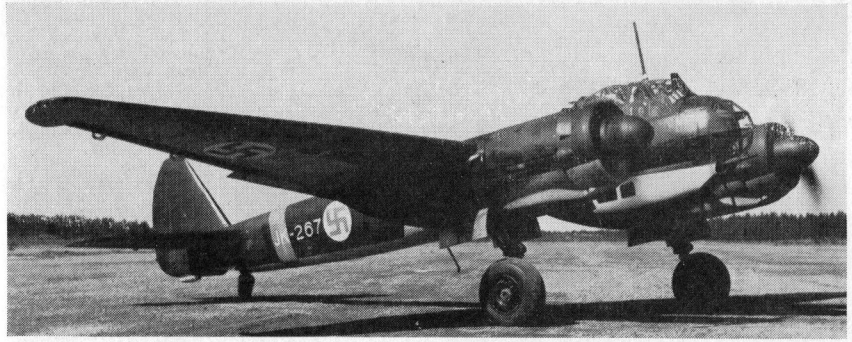
The fender rendered the Ju 88A-6 extremely vulnerable to fighter interception, and the limited success that it enjoyed on operations resulted in its early withdrawal from the balloon-destroying role. Most aircraft of this



type reverted to normal bomber operations with fender and compensating weight removed, and others were later modified for the long-range maritime role with the crew complement reduced to three, the ventral gondola removed and FuG 200 *Hohentwiel* radar mounted in the nose. Drop tanks were attached inboard of the engine nacelles, Jumo 211J engines were installed, and in this form the aircraft was known as the **Ju 88A-6/U**.

Before the Ju 88A-4 finally made its appearance on the assembly lines, a small number of Ju 88A-5 airframes were completed as dual-control pilot trainers with Jumo 211H-1 engines under the designation **Ju 88A-7**.

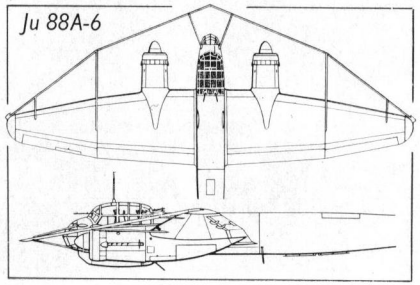
The first Ju 88A-4s manufactured received the Jumo 211F-1 engine pending availability of the definitive Jumo 211J, these being rated at 1,340 h.p. for take-off, 1,350 h.p. at 820 ft., and 1,060 h.p. at 17,000 ft. Relatively few Ju 88A-4s had been delivered before the Jumo 211J became available for installation, and by this time considerable changes had been made in both defensive armament and crew protection as a result of experience gained by the Ju 88A-equipped *Kampfgruppen* during the "Battle of Britain". Although the Ju 88A had fared better than other *Luftwaffe* bombers participating in that epic action, its high diving speed enabling it to evade even the Spitfire, combat attrition had been by no means inconsiderable. Thus, the defensive armament of the Ju 88A-4 was markedly improved. The MG 15 was replaced by the far superior MG 81 of similar calibre, and several alternative defensive arrangements were adopted for various production batches, but the pilot's single forward-firing 7.9-mm. weapon, which could be used either fixed or free, was supplemented by either one 13-mm. MG 131 or two 7.9-mm. MG 81s fired by the bombardier through the transparent panels of the fuselage nose, either one MG 131 or two MG 81s were provided to fire aft from the ventral gondola, and two MG 81s fired aft from the rear of the cockpit canopy. From mid-1941, the aft-section of the cockpit canopy was bulged to provide more space for manipulating the guns, and incorporated new circular armoured mountings for the twin MG 81s.

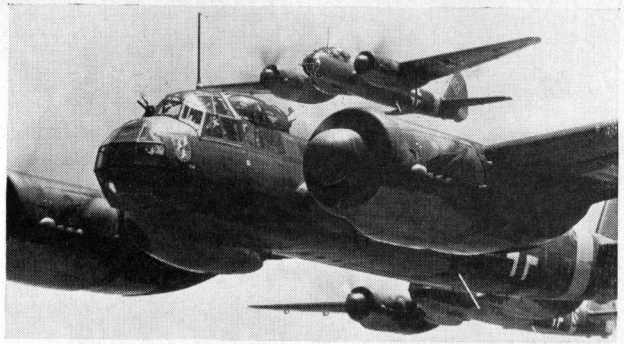


An ex-Luftwaffe Ju 88A-4 of the Finnish unit PLeLv 44 which began to convert to this bomber in 1943. PLeLv 44 subsequently operated against both Russian and German forces.

The pilot was protected by a back plate, side pieces, a head plate and under-seat slats of 4-mm. and 9-mm. thickness, a folding flap of armour protected the upper aft gunner's chest, the ventral aft gunner being protected by strips of 4-mm. armour along the floor of the gondola, and the gun mounting itself which consisted of two curved 8.5-mm. armour shields and a 7-mm. armour base. The forward bomb-bay was deleted, this space normally being occupied by a fuel tank, the bulk of the load being carried externally, and this could comprise two 1,105-lb. bombs on the inboard ETC carriers, two 551-lb. bombs on each of the two carriers immediately inboard of the engine nacelles, and two 551-lb. bombs on the outboard carriers. The remaining internal bomb-bay could take 10 110-lb. bombs, a flare or an incendiary bomb container. Skis could be fitted in place of the normal wheel undercarriage, and take-off rocket attachment points were fitted as standard.

All subsequent A-series production aircraft were based on the Ju 88A-4 but the sub-series





(*Above*) *Ju* 88*A*-4*s of III/LG* 1 *over the Soviet Union during the summer of* 1942, *and* (*below*) *a Ju* 88A-6 *during the winter of* 1941–42.

numbers were not necessarily indicative of the sequence in which variants entered service as these were applied to machines modified by conversion centres as well as to machines on the assembly lines on which were introduced major equipment changes. Furthermore, standard bombers adapted for different operational roles or environments by conversion centres were, in certain cases, allocated new sub-series numbers retrospectively. For example, the tropicalized versions of the Ju 88 A-1 and A-5 with sand filters, sun-blinds, and desert survival equipment were designated **Ju 88A-9** and **A-10** respectively, yet these preceded into service the **Ju 88A-8** based on the A-4. The A-series variants based on the Ju 88A-4 were as follows:

Ju 88A-8: Interspersed on the assembly line among early production Ju 88A-4s, the Ju 88A-8 embodied balloon cable-cutting capability, the so-called *Kuto-Nase* cutters being built into the wing leading

edges. The crew complement was reduced to three members, and power was provided by Jumo 211F-1 engines. A relatively small number of aircraft of this sub-type were delivered in 1941.

Ju 88A-11: With the appearance of the Ju 88A-4 in the Mediterranean and North Africa these aircraft were tropicalized by forward maintenance units and the designation **Ju 88A-4/Trop** applied, but when manufactured from the outset for tropical operation they were allocated the designation Ju 88A-11.

Ju 88A-12: A number of Ju 88A-4s adapted by a conversion centre for the dual-control training role received the designation Ju 88A-12. The ventral cupola, dive brakes and all armament were removed.

Ju 88A-13: A number of Ju 88A-4 bombers were rebuilt for the low-level assault role under the designation Ju 88A-13. The dive brakes and bomb sight were removed and additional armour was provided to protect the crew, engines and fuel tanks. Attack armament comprised 1,100 lb. of small fragmentation bombs and up to 16 fixed forward-firing 7.9-mm. MG 17 machine guns, the majority of which were housed in pods attached to the ETC racks beneath the wings.

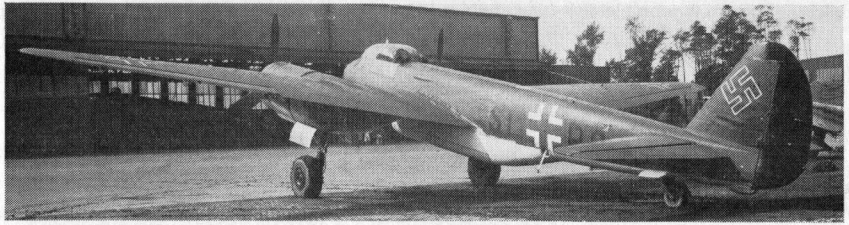
Ju 88A-14: Essentially an improved Ju 88A-4 with similar equipment to the earlier production variant, the Ju 88A-14 embodied some increase in armour protection for the crew, standardized on the *Kuto-Nase* balloon-cable cutters, and introduced some minor refinements. A number of Ju 88A-14s were fitted with a 20-mm. MG FF cannon in the ventral gondola, the bombsight being removed to enable the installation to be made. This cannon was intended primarily for attacks on shipping, and a number of Ju 88A-4s had

A close-up view of the nose of the Ju 88*A*-17 *torpedo-bomber with two LT F5b torpedoes.*

previously been converted to take the MG FF which, in some aircraft, was mounted to fire through the starboard side of the nose glazing.

Ju 88A-15: Based on the Ju 88A-4 airframe, the Ju 88A-15 featured an enlarged wooden bomb-bay capable of housing a maximum of 6,614 lb. of bombs. The ventral gondola was deleted, the crew complement was reduced to three members, and defensive armament was restricted to two 7.9-mm. MG 15 machine guns.

Ju 88A-16: A dual-control trainer conversion



A Ju 88A-15 (Werk-Nr. 140561) which, based on the A-4 airframe, featured an enlarged wooden bomb-bay and lacked the standard ventral gondola.

of the Ju 88A-14 with the ventral gondola removed and armament deleted was designated Ju 88A-16.

Ju 88A-17: A number of Ju 88A-4s were adapted in 1942 for the torpedo-bombing role under the designation **Ju 88A-4/Torp**, and a small series of aircraft manufactured from the outset for this role were designated Ju 88A-17 and operated by *Kampfgruppe* 28 on shipping strikes. One PVC rack beneath each wing root supplanted the four ETC racks inboard of the engine nacelles, and two 1,686-lb. LT F5b torpedoes were carried, a long bulged housing on the starboard side of the nose containing the equipment for adjusting the steering mechanism of the torpedoes in the air. The crew complement usually comprised three members, and the offset ventral gondola was deleted from some aircraft of this type.

The production tempo of the Ju 88A gathered momentum extremely rapidly, and whereas 110 aircraft of this type had been accepted by the *Luftwaffe* by the end of 1939, no fewer than 2,184 Ju 88s were accepted during 1940, of which some 60 were night fighters and 330 reconnaissance models. The total production for 1941 had risen to 2,619 of which just under 2,000 were bombers, while in 1942, despite the phasing out of the Dornier factory at Wismar, the Arado factory at Brandenburg, and the Heinkel factory at Oranienburg during the first months of the year, total Ju 88 acceptances rose to 3,094 aircraft of which some 2,270 were bombers. The Ju 88 was by now numerically the most important weapon in the inventory of the *Kampfgruppen*, active over every front on which German forces were engaged, and truly the backbone of the *Luftwaffe*, and from early 1943, the Ju 88 began to appear in service with Germany's allies.

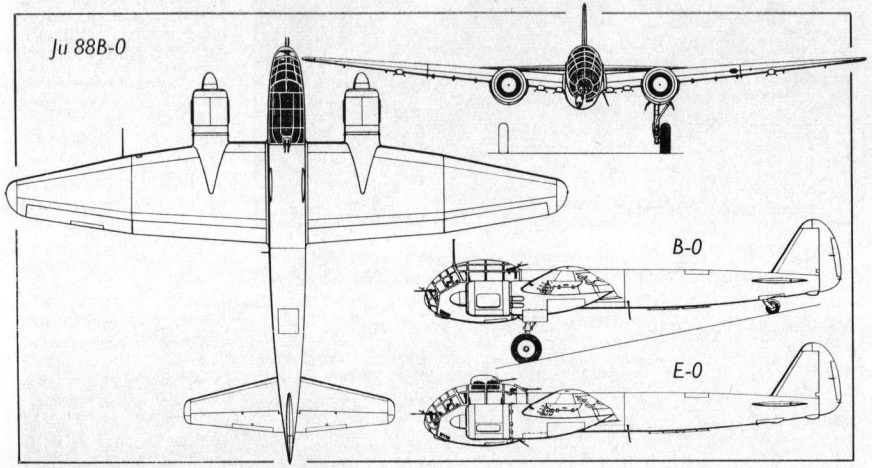
JUNKERS JU 88B

When, early in 1936, Junkers first submitted its Ju 85 and Ju 88 proposals to the *Technische Amt*, the design bureau appended studies for what were referred to as the **Ju 85B** and **Ju 88B**, these differing from the basic projects in featuring deeper, more extensively glazed forward fuselages from which the stepped windscreen had been eliminated. Although offering somewhat less drag than the orthodox stepped arrangement, this alternative forward

fuselage was considered too radical by the traditionalists on the staff of the *Technische Amt*, and was accordingly shelved. However, early in 1939, by which time the Ju 88A had reached the assembly lines, the Dessau design bureau resurrected the Ju 88B project and re-submitted it to the *Technische Amt*.

In the form now proposed, the Ju 88B was thoroughly up-dated, and while based on the Ju 88A-1 airframe, it envisaged the use of the new Junkers Jumo 213 engine, which, at that time, had commenced bench running and was expected to offer 1,500 h.p. for take-off and 1,240 h.p. at 18,045 ft. Three versions were projected: a three-seat level and dive-bomber, and two-seat *Zerstörer* and long-range reconnaissance models, the two-seaters featuring a shallower forward fuselage, the ventral bulge being deleted. Maximum and cruising speeds of the order of 350 and 320 m.p.h. respectively were predicted, but the *Technische Amt* considered the performance offered by the Ju 88A to be perfectly adequate for the immediate future. Nevertheless, Junkers was encouraged to proceed with development of the Ju 88B as a low-priority programme, but was instructed to modify the project to take the compact, small-diameter BMW 139 14-cylinder air-cooled radial which had attained a more advanced development stage than the liquid-cooled Jumo 213, and to increase the crew complement to four members.

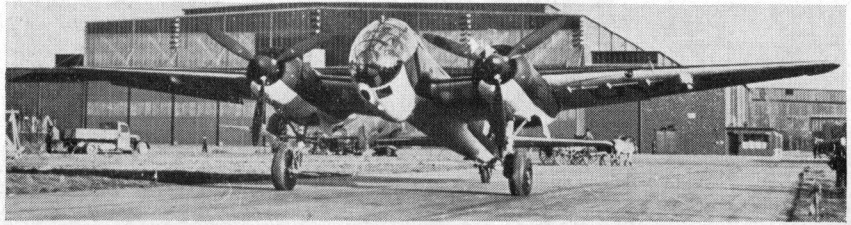
The prototype, the **Ju 88B V1** (D-AUVS), was flown for the first time early in 1940 with



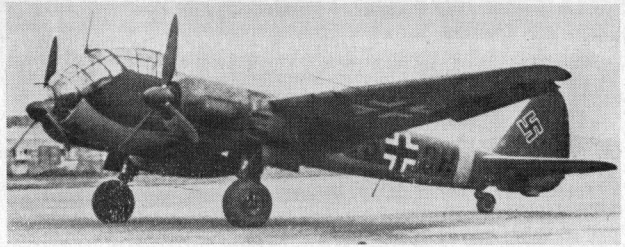
two BMW 801MA radials which supplanted the BMW 139, these each being rated at 1,600 h.p. for take-off and 1,380 h.p. at 15,100 ft. Apart from the forward fuselage, the airframe was similar to that of the Ju 88A-1, and internal bomb-bay capacity was identical, but the ETC racks beneath the wing centre section were augmented by a rack beneath each outer panel.

The pre-production **Ju 88B-0**, 10 examples of which began to leave the assembly line during the summer of 1940, was similarly powered to the prototype but was based on the Ju 88A-4 airframe, overall span being increased accordingly from 60 ft. 3¼ in. to 65 ft. 7½ in. Another change introduced on the pre-production model was some lengthening of the forward fuselage to improve visibility for the crew members and, simultaneously, rectify some stability shortcomings experienced with the Ju 88B V1, overall

(*Left and below*) *The Ju 88B V1 (D-AUVS) which was flown early in* 1940.



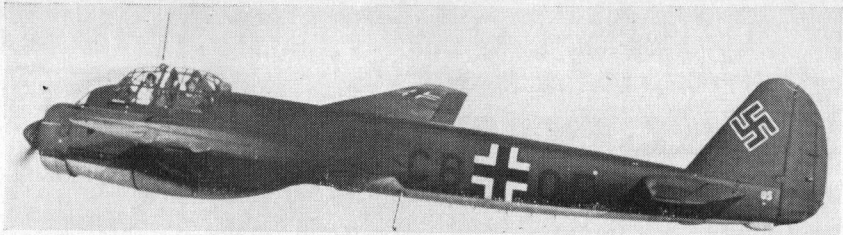
(*Right*) *A Ju 88B-0 adapted for the long-range reconnaissance role and used by the Aufklärungsgruppe of the Oberbefehlshaber der Luftwaffe.*

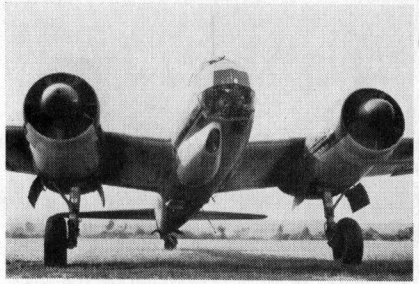


length being increased from 46 ft. 8½ in. to 49 ft. 0½ in. The BMW 801MA engines were retained, maximum speed was 311 m.p.h., service ceiling was 30,840 ft., and range was 1,555 miles. Defensive armament comprised six 7.9-mm. MG 81 machine guns mounted in pairs to fire forward through the nose glazing, and aft above and below the fuselage. Maximum bomb load was 5,510 lb., and maximum loaded weight was 26,015 lb.

Service evaluation was generally successful, the new forward fuselage proving popular, but the performance improvement over the existing Ju 88A-5 and the forthcoming Ju 88A-4 was considered to be too marginal to warrant disrupting existing production lines at that stage of the war by switching from the Ju 88A to Ju 88B. Junkers was therefore instructed to continue with development of the basic design, and most of the Ju 88B-0s were adapted for the long-range reconnaissance role, the bomb-sight being removed, the fuselage bomb-bays being blanked off, a 268 Imp. gal. fuel tank being inserted in the space formerly occupied by the forward bomb-bay, and a 149.6 Imp. gal. tank taking the place of the aft bomb-bay, and provision being made for drop tanks beneath the wing centre section. The ETC racks were removed from the outer wing panels, and cameras were fitted. So modified, these aircraft were delivered to the special *Aufklärungsgruppe* of the *Oberbefehlshaber der Luftwaffe*.

Several other Ju 88B-0s were retained by Junkers for development purposes, one of these being re-engined with BMW 801C engines possessing similar ratings to the BMW 801MA. This aircraft was also fitted with a small power-operated turret housing a single MG 131 machine gun, and was redesignated **Ju 88E-0**, and as progress with the Ju 288 was proving disappointing, the *Technische Amt* instructed Junkers to develop this aircraft further as the Ju 188. The sole example of the Ju 88E-0 thus became an armament development aircraft for the Ju 188, and, in addition to the dorsal turret mounting a 13-mm. MG 131 machine gun, was fitted with two additional weapons of similar calibre, one firing forward through the nose glazing and the other firing aft above the fuselage from the rear of the cockpit glazing. An MG 81Z installation (two 7.9-mm. MG 81s) firing aft was provided in the ventral step of the forward fuselage. As the roles of the Ju 188 were to include anti-





(Above and left) The Ju 88D-0. The photograph above illustrates the fifth example, and that left shows the tri-camera arrangement later standardized by the Ju 88D-5.

shipping operations, two Ju 88B airframes with mock-up engines and wing outer panels detached were employed to test the characteristics of the aircraft during emergency landings on water. These were catapulted into the River Elbe at approximately the same touch-down speeds at which a damaged aircraft would strike the water under operational conditions.

JUNKERS JU 88D

The increasing need for specialized strategic reconnaissance aircraft possessing higher performance than that offered by the Do 17P equipping the long-range *Aufklärungsgruppen* resulted, early in 1940, in the appearance of the Ju 88D based on the Ju 88A-4. The forward bomb-bay was blanked over and used for fuel, no dive brakes were fitted, and aft of fuselage frame No.15 provision was made for either two or three remotely-controlled cameras with the necessary heating installation. The most widely-used installation comprised a single high-altitude Rb 50/30 camera suitable for use up to altitudes of the order of 28,000 ft., and an Rb 20/30 which was not intended to be used above 6,500 ft.

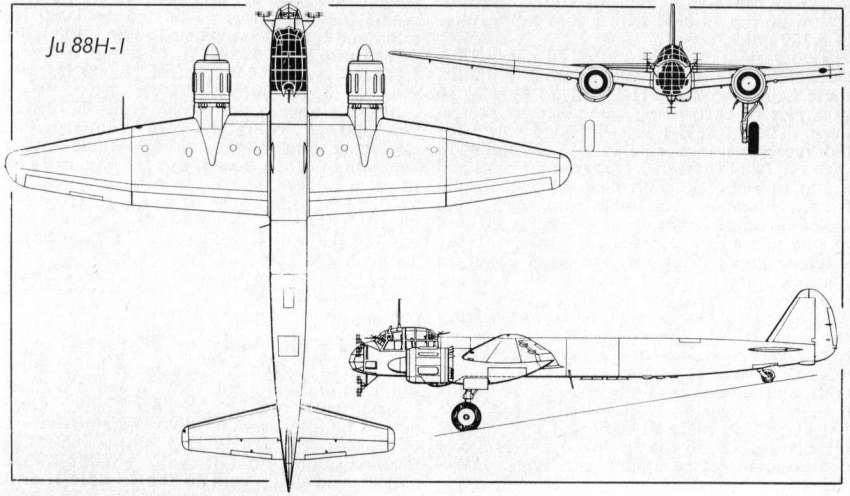
Like the Ju 88A-4 bomber, it was intended to power the **Ju 88D-1** with the Jumo 211J-1 and J-2, but the pre-production **Ju 88D-0** reconnaissance aircraft were delivered with Jumo 211B-1 engines and without the ETC racks beneath the wing centre section, and the non-availability of the Jumo 211J resulted in the initial production model being the **Ju 88D-2** with Jumo 211B-1, G-1 or H-1 engines,

this version being equivalent to the Ju 88A-5 bomber. The ETC racks were reinstated on the Ju 88D-2, and for extended-range missions a drop tank was slung beneath each pair of racks. The crew complement remained four members, but defensive armament was normally restricted to three 7.9-mm. MG 15 machine guns. A tropicalized version, initially known as the **Ju 88D-2/Trop**, was later redesignated **Ju 88D-4**.

As supply of the Jumo 211J-1 and J-2 engines eased, the Ju 88D-2 gave place on the assembly lines to the Ju 88D-1 which was identical to the initial model apart from the power plants, although some aircraft had the outboard ETC racks deleted, only the inboard racks being retained for the drop tanks. The tropicalized variant of the Ju 88D-1 was designated **Ju 88D-3**, and a variant standardizing on the tri-camera arrangement of Rb 50/30s and Rb 75/30s employed by some Ju 88D-2s and manufactured in parallel with the D-1 was designated **Ju 88D-5**.

JUNKERS JU 88H

Late in 1942, a requirement for an ultra-long-range reconnaissance aircraft led to the development of the Ju 88H which was produced at Merseburg from a combination of Ju 88D-1 and Ju 88G-1 components. The

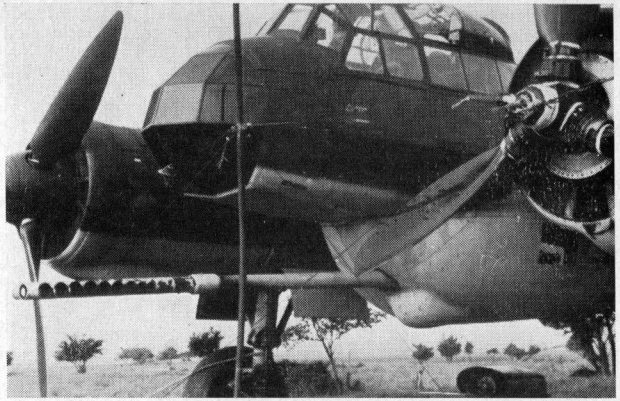


wings of the Ju 88G-1, complete with BMW 801D engines each offering 1,700 h.p. for take-off and 1,440 h.p. at 18,700 ft., fuel tanks with a total capacity of 369.5 Imp. gal., and under-carriage main members, were married to the fuselage and tail surfaces of the Ju 88D-1. The offset gondola beneath the forward fuselage was removed, and additional fuselage sections were inserted forward (3 ft. 3 in.) and aft (7 ft. 6½ in.) of the wing to result in an overall length of 57 ft. 10¾ in., the additional sections enabling the fuselage to house three 268 Imp. gal. fuel tanks and one 230 Imp. gal. tank. Total maximum internal fuel capacity was thus raised to 1,423.5 Imp. gal., and this could be augmented by two 198 Imp. gal. drop tanks slung beneath the wing roots, endowing the Ju 88H with a maximum range of 3,200 miles.

Two variants were produced in parallel for extended-range missions over the Atlantic, these being the **Ju 88H-1** and **Ju 88H-2**, 10 examples of each being assembled at Merseburg. The Ju 88H-1 was intended solely for the reconnaissance role, and was equipped with FuG 200 *Hohentwiel* radar in the nose and a trio of remotely-controlled Rb cameras in the aft fuselage. The crew comprised three members and defensive armament consisted of one WT 81Z (twin fixed 7.9-mm. MG 81 machine guns) firing forward from a bulged housing offset to port beneath the forward fuselage, one fixed or flexible forward-firing MG 81, and a similar weapon firing aft from the rear of the cockpit glazing. The Ju 88H-2 was intended for *Zerstörer* operations against Allied long-range convoy escort aircraft, and differed from the H-1 only in having a battery of six forward-firing 20-mm. MG 151 cannon in place of the radar and camera installations. Both the Ju 88H-1 and H-2 saw operational service under the *Fliegerführer Atlantik*.

During 1943, proposals were made to fit the Ju 88H-1 with BMW 801TG engines with exhaust-driven turbo-superchargers and a pair of BMW 003A-1 turbojets, the latter being slung from the wing-root racks to provide over-target boost, escape speeds sufficient to ensure the evasion of enemy interceptors, or extremely high cruising speeds to reduce time to and from the reconnaissance target in cases where vital urgency was attached to the obtaining of photographic intelligence. It was anticipated that the BMW 003A-1 turbojets would increase the maximum speed of the Ju 88H-1 from 343 m.p.h. at 21,000 ft. to 442 m.p.h. at 23,000 ft. and 446 m.p.h. at 29,500 ft. Initial climb rate at sea level at a loaded weight of 24,800 lb. and with all four power plants operating was calculated at 3,900 ft./min., and range was expected to be 1,100 miles at 385 m.p.h. at 42,000 ft. as compared with 1,865 miles at 274 m.p.h. at 36,000 ft. with only the BMW 801TG engines in use.

These proposals did not see fruition, further development being devoted primarily to stretching the already considerable range capability of the aircraft, this leading, in 1944, to yet a further increase in fuselage length to 67 ft. 7¾ in., this "stretch" resulting from the insertion of an additional 9 ft. 9 in. section forward of the wing leading edge. This permitted a fourth 268 Imp. gal. fuel tank to be introduced, and as the maximum fuel load alone now weighed 15,255 lb., the BMW 801D engines were supplanted by Jumo 213A-12s each rated at 1,776 h.p. for take-off, this being increased with MW 50 (methanol-water) injection to 2,240 h.p. The extended 26 ft. 3 in. tailplane and enlarged, more angular vertical tail surfaces of the Ju 88G fighter were adopted, and, again, two versions were envisaged: the **Ju 88H-3** ultra-long-range reconnaissance aircraft with similar radar and camera equipment to the Ju 88H-1, and



The Ju 88P V1, a Ju 88A-4 adapted during the summer of 1942 for trials with the 75-mm. KwK 39 cannon.

the **Ju 88H-4** *Zerstörer*. In the event, neither version attained operational service, and the few completed examples were adapted for *Mistel* tasks.

JUNKERS JU 88P

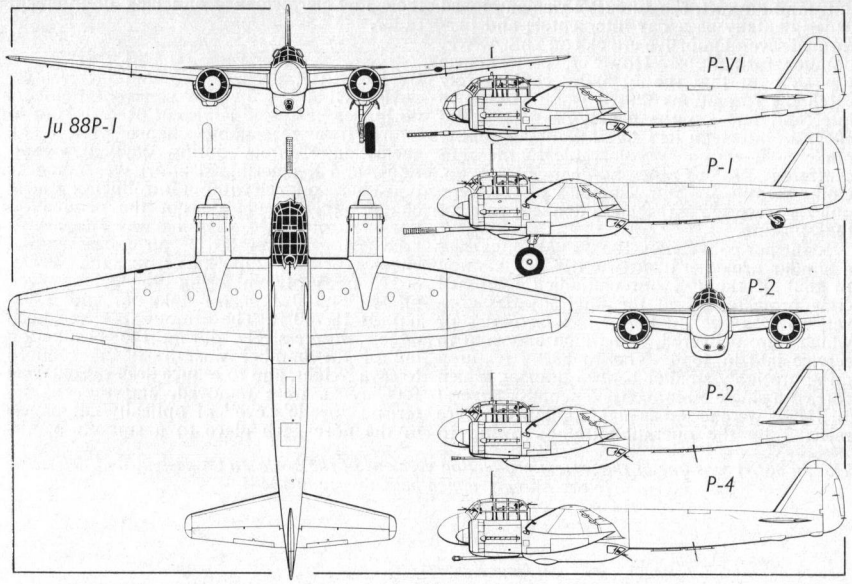
The pressing need to evolve an effective countermeasure to the rapidly-multiplying Soviet tanks was rendered obvious after the Crimean battles of 1942, and the highest priority was allocated to the development of anti-tank aircraft carrying weapons capable of penetrating the armour of the KV 1, KV 2 and T-34 tanks. Various schemes were proposed for the ubiquitous Ju 88, and among those tested was the application of a so-called *Nebelwerfer* (sometimes referred to as the *Do-Werfer* after its creator, Professor Dornberger) to an adapted Ju 88C fighter. The *Nebelwerfer* was a small artillery weapon employed by the *Wehrmacht*, this possessing six revolving barrels firing Wfr. Gr. 21 or 28 recoilless shells, and the test vehicle was unofficially designated "Ju 88N" or "Ju 88 Nbwe", but no *official* designation was applied to this aircraft, and tests of the *Nebelwerfer* were abandoned at an early stage in favour of the 75-mm. KwK 39 *Kampfwagen-Kanone*.

A Ju 88A-4 was adapted during the summer of 1942 for trials with the KwK 39 as the **Ju 88P V1**. This weapon was installed in an immense fairing beneath the fuselage which promptly resulted in the aircraft being nicknamed "*Die Dicke Bertha*" (The Fat Bertha) when firing trials began at Bernburg. The original offset ventral gondola was removed, and the cannon housing was extended aft to terminate in a defensive position mounting an MG 81Z (twin 7.9-mm. MG 81 machine guns) firing aft. The gun, which was inclined downwards at a small angle to the line of flight, was hand-

loaded and its barrel projected some 6 ft. ahead of the fuselage nose. The exhaust gases were ejected from either side of the fairing, the exits being sufficiently far aft to avoid any interference with the plane of the airscrews.

Initial firing trials showed sufficient promise to warrant further tests at the Roggenthin satellite of the *Erprobungsstelle* Rechlin where it was evaluated against captured T-34 tanks, two rounds normally being fired during each pass, the first being fired from a height of about 1,000 ft. in a shallow low-speed glide, the second being fired from about 250 ft. The results were relatively satisfactory, and a small batch of additional conversions was ordered. Designated **Ju 88P-1**, these differed from the Ju 88P V1 in having a "solid" nose and the improved 75-mm. PaK 40 cannon with a larger muzzle recoil brake and electro-pneumatic operation. The cannon and its housing rendered the Ju 88P-1 extremely unwieldy and highly vulnerable if intercepted by fighters, and an explosive device was therefore fitted enabling the pilot to jettison the cannon in the event of interception or an engine being knocked out by ground fire. Three crew members were carried, a single forward-firing MG 81 machine gun operated by the

(Left and below) The Ju 88P-3 fitted with a pair of BK 3.7 cannon with which it saw operational service on the Eastern Front.



pilot was used for aiming purposes, and aft defence was provided by two MG 81Z installations firing above and below the fuselage. The Jumo 211J-2 engines were protected by armour and the fuel tanks were deleted from the outer wing panels. Possessing a normal loaded weight of 24,400 lb., the Ju 88P-1 had a maximum speed of only 244 m.p.h.

Tested by the *Versuchs-Kommando für Panzer Bekämpfung* late in 1943, and issued to the *Panzerjäger Staffel* 92 operating on the Eastern Front under the *Führer der Panzerjäger*, the Ju 88P-1 enjoyed some success against Soviet armour, but was generally unsatisfactory owing to low rate of fire of its weapon and its inability to evade interception.

A small number of additional Ju 88A-4 airframes were converted as **Ju 88P-2s**, this conversion being similar to the Ju 88P-1 but the ventral housing mounting two BK 3.7 (Flak 38) cannon of 37-mm. calibre offset to port. Although intended from the outset as an

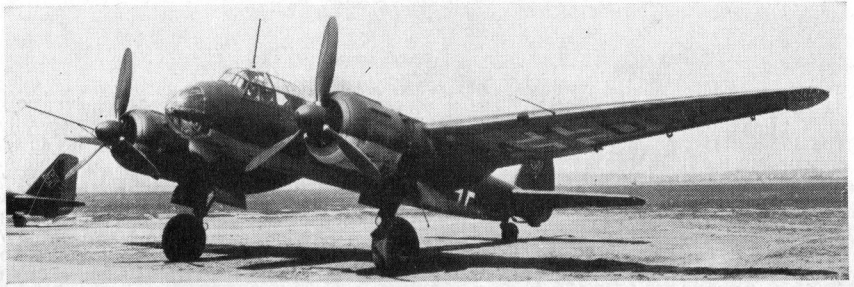
anti-tank aircraft, the Ju 88P-2 was employed experimentally as a day interceptor, and performed several abortive attacks on U.S.A.A.F. bomber formations. However, performance was so poor that the Ju 88P-2 could rarely catch the formations that it was intended to intercept, and on the occasions that it did effect an intercept, its lack of manoeuvrability rendered it extremely vulnerable to the concentrated fire of the bomber formation. Consequently, the few examples of this type quickly reverted to their intended role of tank-busting.

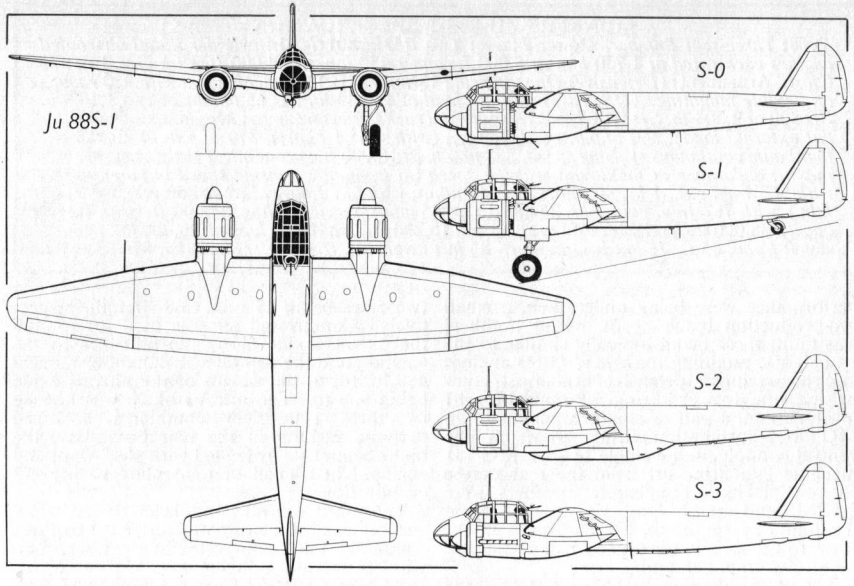
A further conversion, the **Ju 88P-3**, carried a similar armament of two BK 3.7 cannon to that of the P-2 but embodied increased crew protection, and the final P-series conversion was the **Ju 88P-4**, 32 examples of which were delivered, and which appeared in service late in 1944. The Ju 88P-4 featured an appreciably smaller ventral housing which carried a single 50-mm. BK 5 cannon. Several Ju 88P-4s were tested as night fighters but were rejected by the operational units owing to their low performance and lack of intercept radar.

JUNKERS JU 88S

By late 1942, it was becoming increasingly obvious that the Ju 88A series of bombers no longer possessed sufficient performance to afford it a reasonable chance of evading enemy interceptors during daylight operations, and a determined effort was made to boost performance without introducing radical changes that would disrupt the production lines. A Ju 88A-4 airframe was adapted to take two BMW 801D air-cooled radial engines which, differing from the BMW 801A primarily in using 96 Octane fuel, offered 1,700 h.p. for take-off and 1,440 h.p. at 18,700 ft. The armour that had been added progressively during the production life of the bomber was drastically reduced to save weight, and to reduce drag the external ETC racks were removed, and the characteristic "beetle's eye" of optically-flat panels in the nose gave place to a smooth hemis-

The Ju 88S-1 was one of the fastest production versions of the basic Ju 88 design, and deliveries to the Kampfgruppen began early in 1944.





pherical glazed nose cap. With these modifications the test aircraft was designated **Ju 88 V93**, this *Versuchs* number being indicative of the number of Ju 88s applied to experimental development programmes since the autumn of 1941, when the Ju 88 V27 had first flown as the prototype for the Ju 188.

The Ju 88 V93, also known as the **Ju 88S V1**, attained a maximum speed of 332 m.p.h., but although this represented a marked improvement over the standard Ju 88A-4, it was considered insufficient by the *Technische Amt* which was now demanding a performance that would enable the bomber to elude enemy interceptors entirely. The Junkers design bureau concluded that such a performance increment could be obtained only at the expense of most of the remaining armour and defensive armament, by reducing the crew complement from four to three members, and by providing additional power.

While investigations of means of improving

JUNKERS JU 88S-1 SPECIFICATION

Type: *Three-seat Bomber.* **Power Plants:** *Two BMW 801G-2 14-cylinder radial air-cooled engines each rated at 1,730 h.p. at 5,000 ft. and 1,430 h.p. at 24,000 ft. with GM 1 power boost.* **Armament:** *(Defensive) One aft-firing 13-mm. MG 131 machine gun with 250 rounds on flexible mounting. (Offensive) Internal load of 14 143-lb. SD 65 bombs or two 1,102-lb. SD 500 or 2,205-lb. SD 1000 bombs on external racks.* **Performance:** *Maximum speed (without external load), 340 m.p.h. at 26,250 ft., (with GM 1 boost), 379 m.p.h. at 26,250 ft.; maximum continuous cruising speed, 328 m.p.h. at 18,000 ft.; economical cruising speed, 289 m.p.h.; endurance at maximum cruising speed (at economic cruising speed in parentheses) with 369 Imp. gal., 1 hr. 40 min. (2 hr. 45 min.), with 637 Imp. gal., 2 hr. 50 min. (4 hr. 40 min.), with 787 Imp. gal., 3 hr. 25 min. (5 hr. 45 min.); service ceiling, 34,000 ft. (with GM 1 boost), 38,000 ft.* **Weights:** *Empty equipped, 18,250 lb.; maximum loaded, 30,400 lb.* **Dimensions:** *Span, 65 ft. 7½ in.; length, 48 ft. 8⅜ in.; height, 15 ft. 8½ in.; wing area, 586.63 sq. ft.*

performance were being undertaken, a small pre-production batch of **Ju 88S-0** bombers was built, these being basically similar to the Ju 88S V1, retaining the BMW 801D engines and possessing a defensive armament comprising one forward-firing 7.9-mm. MG 81 machine gun, a pair of similar weapons in an MG 81Z installation firing aft from the ventral gondola, and a single 13-mm. MG 131 machine gun firing aft from the rear of the cockpit glazing. Four crew members were carried, and bomb load was limited to a maximum of 14 143-lb. SD 65 bombs in the forward bomb-bay, the aft bay being occupied by a 149.6 Imp. gal. tank.

The pre-production Ju 88S-0 was followed in the late autumn of 1943 by the production **Ju 88S-1** which differed from its predecessor in a number of respects. The BMW 801D engines gave place to BMW 801G-2s with a GM 1 power boost (nitrous oxide injection) which increased output to 1,730 h.p. at 5,000 ft. and 1,430 h.p. at 24,000 ft. The injection was arranged at two rates, the "normal" rate of 7.95 lb. per engine per minute and the "emergency" rate of 13.2 lb. per engine per minute, the endurance of the system at the two rates being 45 min. and 27 min. respectively. Compressed air was used for forcing the nitrous oxide along the pipelines to the engines, and the complete installation weighed 400 lb. (dry), the weight of the nitrous oxide being 900 lb. The nitrous oxide was housed by three cylindrical containers arranged pyramid fashion in the rear bomb-bay, the tanks being heavily lagged with glass wool and enclosed in a shell of light alloy to prevent evaporation.

The offset ventral gondola of the Ju 88S-0 was removed, the crew was restricted to three members—pilot, navigator/bombardier, and wireless operator/gunner—and defensive armament was restricted to one aft-firing 13-mm. MG 131 machine gun with 250 rounds firing from the rear of the cockpit glazing. Armour was reduced to the pilot's seat and an armour-glass screen forming part of the MG 131 mounting, and some 4-mm. plate beneath the oil coolers. The moulded Plexiglas nose included a heated optical flat to provide the pilot with downward view, neither dive brakes nor automatic pull-out gear were fitted, the forward bomb-bay could house a 268 Imp. gal. auxiliary tank, and provision was made for an

external load of two 2,205-lb. SD 1000 bombs beneath the wing centre section. Normal and maximum loaded weights were 24,250 and 30,400 lb. respectively, and maximum speed without external load ranged from 340 m.p.h. to 379 m.p.h. at 26,250 ft. without and with GM 1 boost respectively.

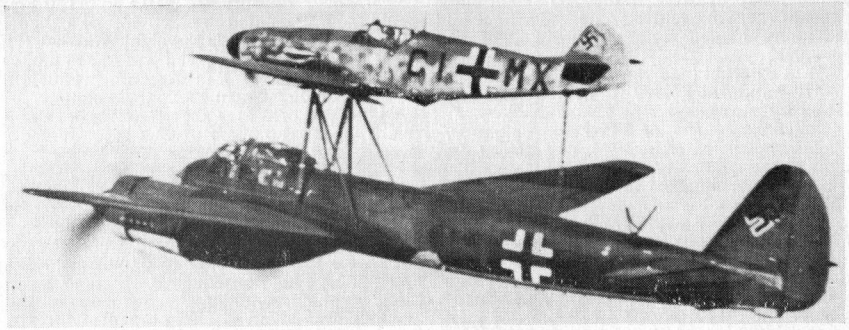
Deliveries of the Ju 88S-1 to the *Kampfgruppen* began early in 1944, one of the first units to receive this type being I/KG 66 which was primarily engaged in Pathfinder missions in the West, and further development resulted in the **Ju 88S-2** with BMW 801TJ engines which were basically similar to the BMW 801D but fitted with exhaust-driven turbo-superchargers which enabled the weighty and space-consuming GM 1 equipment to be eliminated. The BMW 801TJ offered 1,810 h.p. for take-off and 1,500 h.p. at 40,000 ft., and in order to provide more space for internal fuel stowage, a wooden pannier or tray similar to that of the Ju 88A-15 was adopted, this housing a 6,614-lb. bomb load. The original fore and aft bomb-bays were occupied by 268 and 149.6 Imp. gal. tanks respectively, and the single-gun defensive armament was augmented by a pair of fixed aft-firing 7.9-mm. MG 81s mounted in the rear of the wooden pannier. Despite the increased drag resulting from the introduction of the pannier, maximum speed at normal loaded weight was reduced only marginally, and a small series of Ju 88S-2 bombers was produced during the spring and early summer of 1944.

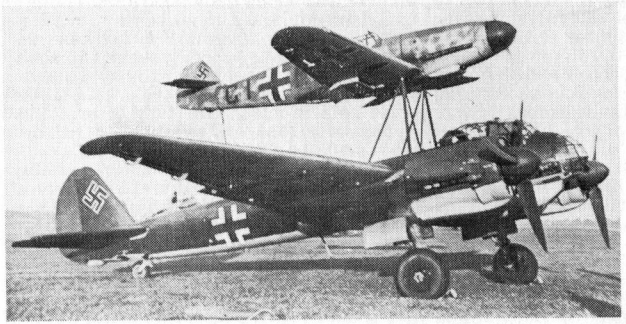
The final S-series development was the **Ju 88S-3** which, basically similar to the S-1, had Junkers Jumo 213A engines with GM 1 boost, the nitrous oxide being housed in a large 75 Imp. gal. cylindrical container in the rear bomb-bay, this boosting take-off power from 1,776 h.p. to 2,125 h.p. with injection at the "normal" rate and 2,300 h.p. at the "emergency" rate. At 18,000 ft. the "normal" and "emergency" outputs of 1,950 and 2,120 h.p. could be augmented by 340 lb. of exhaust thrust. Normal loaded weight was 23,126 lb. at which maximum speed was 382 m.p.h. at 27,900 ft. with GM 1 in use, and production of the Ju 88S-3 began late in the summer of 1944 but was cancelled shortly afterwards, and relatively few bombers of this type were delivered.

JUNKERS JU 88T

The performance shortcomings displayed by the Ju 88A bomber as Germany switched from the offensive to the defensive were equally applicable to the Ju 88D reconnaissance aircraft, and, in consequence, a high-speed photographic reconnaissance version of the Ju 88S was evolved in parallel with the bomber, this being designated Ju 88T, and in its T-1 version, this aircraft began to reach the long-range *Aufklärungsstaffeln* early in 1944. The **Ju 88T-1** was generally similar to the Ju 88S-1 but the forward bomb-bay housed a 268 Imp. gal. fuel tank, the aft bomb-bay could contain either GM 1 tanks or a 149.6 Imp. gal. fuel tank, and two 198 Imp. gal. drop tanks could be carried beneath the wing centre section. Various optional camera arrangements were available, but most aircraft carried an Rb 20/30 and either an Rb 50/30 or 75/30 aft of fuselage frame No. 15. Three crew members were carried and defensive armament comprised either one 13-mm. MG 131 or two 7.9-mm. MG 81 machine guns firing aft.

A parallel development to the Ju 88S-3 bomber with Jumo 213A engines was the **Ju 88T-3** photo-reconnaissance aircraft. Possessing a maximum take-off weight of 29,500 lb. with two 198 Imp. gal. drop tanks, the Ju 88T-3 achieved a range of 1,980 miles at maximum continuous cruising speed at 27,900 ft., attaining a maximum speed of 382 m.p.h.





(Above and left) The prototype Mistel conversion comprising a Ju 88A-4 and a Messerschmitt Bf 109F.

at that altitude which, without drop tanks, could be increased to 410 m.p.h. Preparations were made for large-scale production of the Ju 88T-3 at Henschel's Schönefeld factory in the autumn of 1944, but these plans were cancelled in favour of production of the Me 410.

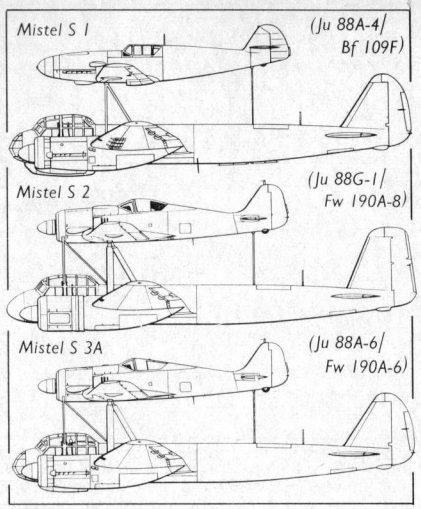
JUNKERS JU 88 MISTELN

During 1943, the already unparalleled versatility of the Ju 88 was expanded still further by its adaptation as a missile—a pilotless aircraft with a large hollow-charge warhead which was guided to the vicinity of its target by a single-seat fighter temporarily attached to a superstructure above the fuselage. The idea of using time-expired Ju 88 airframes in this fashion was allegedly that of a Junkers test pilot, Siegfried Holzbauer, who, undoubtedly influenced by the successful pre-war trials with

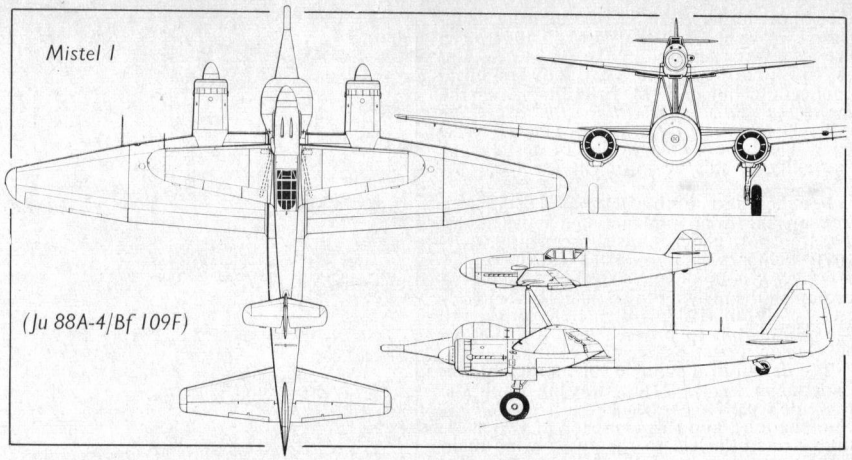
the Short-Mayo S.20/S.21 composite, suggested this scheme to the RLM in 1941. The proposal was dismissed by the *Technische Amt* as too unorthodox to have any practical application, but in 1942, Fritz Stamer of the *Deutsches Forschungsinstitut für Segelflug* initiated a series of *Huckepack* (Pick-a-back) trials with the primary aim of testing the feasibility of this arrangement for transport gliders.

For these tests both a Klemm K1 35 and a Focke-Wulf Fw 56 were mounted above a DFS 230 transport glider, and, subsequently, a Bf 109E fighter was also tested as the upper *Huckepack* component. The success achieved prompted the revival of Holzbauer's proposals and, early in 1943, instructions from the *Technische Amt* to proceed with a prototype conversion.

The design of a suitable superstructure was undertaken by the DFS, drawing upon the Institute's earlier experience with *Huckepack* combinations, and this consisted of two steel-tube struts attached to the Ju 88 wing main spars on each side of the fuselage, the forward strut being vertical and the aft strut being inclined forward, these attaching at their tips to the arms of a V-strut connected to a fuselage mainframe, thus forming two inclined tripods. The apexes of the tripods were intended to marry up with connections on the mainspar of the fighter forming the upper component. A single strut supported the tail of the fighter, this being spring-operated and when disengaged by the pilot of the upper component sprung back to be caught by a yoke on the rear fuselage of the lower component. This yoke contained an electrical contact which released the main attachment points at the apexes of the tripods immediately the tail-support strut sprung back, and also prevented this strut rebounding to strike the tail of the upper component.



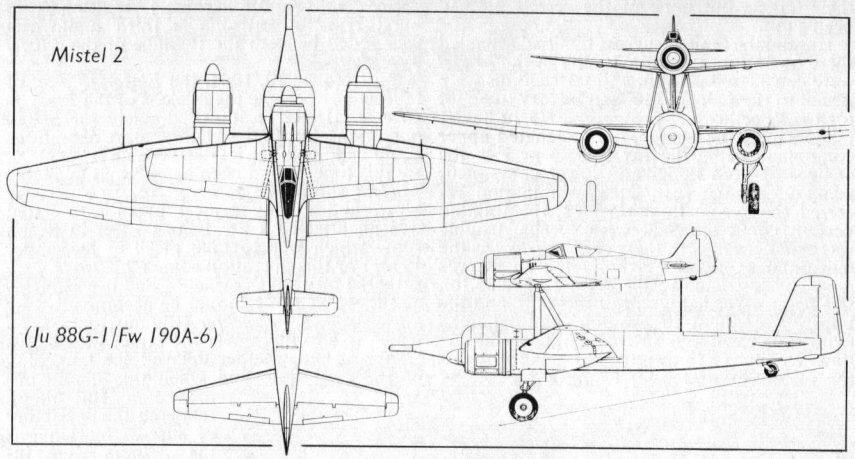
The prototype conversion consisted of a Ju 88A-4 and a Messerschmitt Bf 109F, the lower component being referred to as a *Mistel* (Mistletoe), the connection between this parasitic evergreen and the lower component of the *Huckepack* combination being obvious. The combination was also referred to unofficially as the "*Vater und Sohn*" (Father and Son) after a popular German strip cartoon, but *Mistel* was to become a generic term for the lower component of all such combinations, irrespective of the type of aircraft involved, and when, in July 1943, instructions were given to Junkers to proceed with the conver-



sion of 15 Ju 88A airframes for *Mistel* use, the weapon was allocated the code name "Beethoven". Prototype trials proved successful, and the "Beethoven" programme was transferred to Nordhausen where, during the spring of 1944, pilots of the *Einsatz-Staffel* of IV/KG 101 received conversion training from Junkers test pilots.

The initial model was known as the *Mistel* 1 and comprised a Ju 88A-4 and a Bf 109F-4, the first few conversions being completed as *Mistel S* 1 trainers, the "S" indicating *Schulung* (Training). All *Misteln* were initially flown and tested with the standard nose section, the cockpit being stripped to its bare essentials and providing accommodation for a crew of two. The entire nose section could be detached by means of quick-release bolts and replaced by an 8,380-lb. hollow-charge warhead which used the same attachment points. Large hollow-charge warheads had been tested against the French battleship *Oran* late in 1943 with considerable success, and other experiments were performed in which the warhead was tested against reinforced concrete, the one-ton steel core bursting through concrete some 60 ft. thick. The final warhead tests were performed at Peenemünde in April and May of 1944, and in the following month the *Einsatz-Staffel* of IV/KG 101 arrived at St. Dizier with *Mistel* 1s to attack Allied invasion forces.

The *Mistel* 1 was basically similar to the original prototype conversion, apart from somewhat sturdier bracing struts, and two methods of operation were proposed. The first



of these called for take-off and flight to the target area on the power of the lower component alone, the airscrew of the upper component being feathered and its pilot only starting the engine during the final phase of the approach to the target. The second method of operation was to employ the engines of both components from take-off, the latter being generally adopted, the upper component drawing fuel from the tanks of the lower component until the two parted company. When the objective was reached, the pilot of the upper component set the controls to approach the target in a shallow glide, and at the appropriate distance detached his aircraft and climbed away, the pilotless lower component continuing on its set course.

The *Einsatz-Staffel* of IV/KG 101, commanded by *Hauptmann* Horst Rudat, had five *Mistel* 1s on strength when it arrived at St. Dizier, and performed its first operational sortie on the night of June 24, 1944 with one of these. This proved abortive as the lower component had to be released prematurely when a Mosquito night fighter suddenly appeared. Shortly afterwards, the unit's four remaining *Misteln* were used for a nocturnal attack on Allied shipping in the Seine Bay, this time escorted by Bf 109G fighters. Flares were dropped and the attack pressed home, but results could not be observed owing to the smoke screen emitted by the target vessels. Reconnaissance undertaken on the following day revealed that all the *Misteln* had found

their targets but none of the vessels hit had been sunk.

Despite the limited success that had attended these operations, the potentiality of the *Mistel* were considered proven, and instructions were issued to the Leipzig-Mockau factory to adapt for the "Beethoven" programme 75 Ju 88G-1 fighters awaiting repairs, the designated upper component being the Fw 190A-6 or F-8, the engines of both upper and lower component using 95 octane fuel. This combination received the designation *Mistel* 2, the training version being the *S* 2. Considerable trouble was experienced with these early *Misteln* as the maximum overload weight of the Ju 88 was normally restricted to the order of 30,865 lb., this being exceeded with full fuel load and the upper component in position, and take-offs from rough runways proved extremely hazardous as shocks frequently burst the tyres of the undercarriage. After losing a number of *Misteln* in take-off accidents resulting from burst tyres, a jettisonable third mainwheel was added beneath the fuselage of the *Mistel* 3 series.

On October 10, 1944, the *Einsatz-Staffel* of IV/KG 101 became the nucleus of the *Einsatz-Gruppe* III/KG 66 intended solely for *Mistel* operations, but 10 days later, before operations could be joined, III/KG 66 became II/KG 200. By this time, it had been agreed that available *Misteln* should be reserved for one decisive blow, and among several plans formulated was an attack on the British Fleet in Scapa Flow which was to take place in December 1944. For this operation some 60 *Misteln* were gathered on Danish airfields, and it was intended that this force should be accompanied by 5./KG 200, a *Beleuchter* (Illuminator) *Staffel* which was to illuminate the target with flares. Constant bad weather delayed the launching of the operation, and when this finally improved a full moon rendered the possibility of success marginal as the *Misteln* were incapable of exceeding 235 m.p.h. at 14,765 ft. and, unable to manœuvre and lacking any form of defence, they would have proved easy targets for interceptors.

In January 1945, inclement weather again

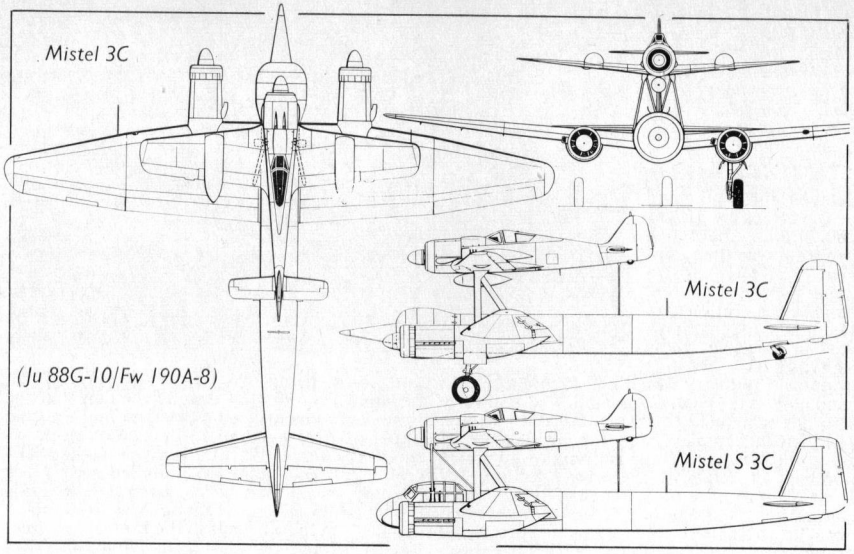
An operational Mistel 1 *comprising a Ju* 88*A*-4 *lower component and Bf* 109*F*-4 *upper component.*

A Mistel 2 *without hollow-charge warhead which was normally fitted immediately prior to an operational mission. Photographed at Merseburg, this Mistel* 2 *comprised a Ju* 88*G*-1 *and an Fw* 190*F*-8.

delayed the launching of the attack by II/KG 200, and an alternative proposal was then considered, this being *Unternehmen Eisenhammer* (Operation Iron Hammer), a scheme to deal a decisive blow against the Soviet armament industry which had for long been a fond plan of the High Command. The operation was not scheduled to take place until March 1945, owing to delays in the availability of sufficient *Misteln* and the training of adequate numbers of pilots, *Eisenhammer* calling for II/KG 200 to have no fewer than 100 *Mistel* 2 composites on strength. The first *Mistel* 2 had been flown in November 1944, a further 50 examples of this combination having been ordered in the following month to increase the total to 125.

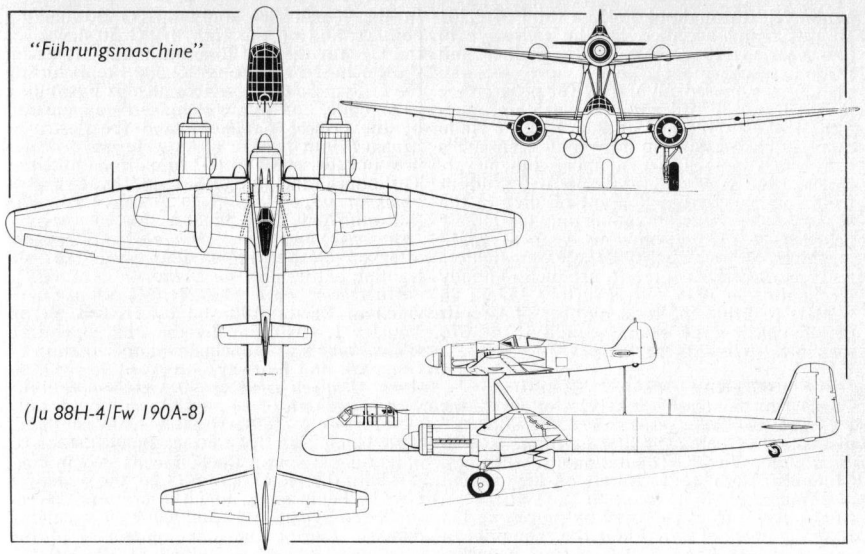
The special training programme was scheduled to be completed by February 1, 1945, and for this the initial composites were completed as *Mistel S* 2 trainers, these having additional bracing struts forward to ensure a clean separation during practice launchings, earlier experience with the *Mistel S* 1 having indicated that trainee pilots had difficulty initially in keeping up the nose of their aircraft. A shortage of BMW 801D-powered Ju 88G-1s resulted in some Jumo 211-powered Ju 88A-4s and A-6s being married to BMW 801D-powered Fw 190A-6s, despite the fact that the lower component used 87 octane fuel and the upper used 95 octane and thus could draw no fuel from the tanks of the twin-engined aircraft. This combination, intended purely for training, was designated *Mistel S* 3*A*.

The training programme was conducted primarily at five airfields in the Merseburg area, but by March the East Prussian bases from which *Eisenhammer* was to have been launched had been overrun by Soviet forces, and, on the 5th of that month, II/KG 200 was ordered to concentrate its *Misteln* against bridges over the Oder, Neisse and Vistula. The *Misteln* of the unit were thus employed piecemeal, one of the first attacks being made by four of II/KG 200's *Misteln* against the Görlitz bridges over the Neisse on March 9th, both North and South bridges being hit. Later in the month, *Misteln* from II/KG 200 attacked bridges across the Rhein, and in April this unit was joined in its bridge



attack sorties by elements of KG 30 which had, in the meantime, also converted to *Misteln*. The *Misteln* units were decimated during these operations, the surviving personnel being hurriedly retrained on fighters.

During the early months of 1945, the tempo of *Mistel* development was accelerated, and Junkers' Bernburg plant began the conversion of brand new airframes still on the assembly line, including the latest Ju 88G-10 and H-4 *Zerstörer* models. The Ju 88G-10 was powered by the Jumo 213A-12 engine using 87 octane fuel, and featured an elongated rear fuselage, an 8 ft. 11¾ in. additional section having been inserted aft of the wing. This was married to an Fw 190A-8 fitted with a pair of 59.4 Imp. gal. aerofoil-shaped overwing tanks known as *Doppelreiter*, and a 66 Imp. gal. ventral drop tank. The second and third fuselage fuel cells of the Ju 88G-10 housed 95 octane fuel from which the Fw 190A-8 was supplied for the outward flight, the remaining tanks being occupied by 87 octane fuel. This model was known as the *Mistel* 3*C*, while a similar conversion of the Ju 88H-4 also employing an Fw 190A-8 as the upper component was designated the *Mistel* 3*B*.



Not all *Misteln* were intended to serve in the attack role, however, as a variant essentially similar to the *Mistel* 3*B* was evolved as a *Führungsmaschine*, an ultra-long-range Pathfinder on which the upper Fw 190A-8 component was intended as a fighter escort for launching in an emergency. The *Führungsmaschine* carried three crew members in the forward fuselage, centimetric radar in an extended nose, a defensive armament of a single aft-firing 13-mm. MG 131 machine gun, and a pair of 198 Imp. gal. drop tanks beneath the wing roots. Several other types of *Misteln* were completed and tested during the last two months of the war in Europe, including one in which a Ju 88G-7 was combined with a Ta 152H, this being tested at the Römergraben airfield, near Quedlinburg, on the fringe of the Harz mountains at the beginning of April 1945. No record of the total number of *Misteln* produced is known to exist, although this must have exceeded 250, and more than 50 were found by the Allies in the Merseburg area alone after the capitulation.

Production of the Ju 88 had remained at a high rate at Bernburg, Leipzig, Halle and

Schönefeld throughout 1943, a total of 3,301 aircraft being accepted by the *Luftwaffe* in that year, 1,100 of these being fighter and reconnaissance models. The Leipzig-Mockau plant finally phased out of the Ju 88 programme in April 1944 in order to concentrate production on the Ju 188 and Ju 388, Siebel's Halle plant following suit in May and Henschel's Schönefeld factory in September, but, nevertheless, the tremendously boosted output from Junkers' Bernburg plant resulted in the year's Ju 88 production falling only marginally below that of the previous year at 3,013 machines, although 2,570 of these were fighters and reconnaissance aircraft, production finally terminating in 1945 with a further 355 Ju 88 fighters to bring the total number of aircraft of this basic type manufactured to 14,676 machines excluding prototypes.

OPERATIONAL CAREER

Formed on September 22, 1939, at Jever, the I *Gruppe* of *Kampfgeschwader* 30 gained the distinction of being the first *Luftwaffe* unit to employ the Ju 88A operationally when, on September 26th, four aircraft on detachment at Westerland/Sylt took-off to attack a British naval force reported by patrolling Do 18 flying boats of 2./K.Fl.Gr.106. The pilot of one of the Ju 88As, *Gefreiter* Carl Francke, believed that one of his two 1,102-lb. SC 500s might have hit the carrier *Ark Royal*, while an SC 500 from one of the other three Ju 88As actually did hit the battlecruiser *Hood* but failed to explode and bounced into the sea. The attack was completely abortive, no British vessel suffering damage, but the German High Command report on the action issued the following day read: "Apart from the destruction of an aircraft carrier, a number of hits were scored on a battleship."

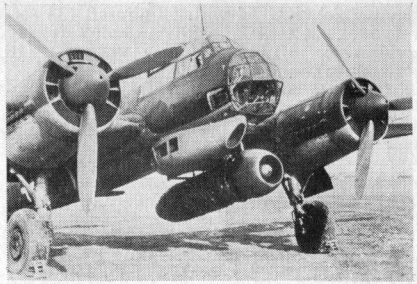
On October 9th, I/KG 30 performed another abortive mission against British naval vessels in the North Sea, only 4./KG 30 making contact, and on the 16th, I/KG 30 flew over the UK for the first time during an attack on the Firth of Forth, one SC 500 bomb hitting the cruiser *Southampton* amidships but failing to explode, and minor damage being suffered by the cruiser *Edinburgh* and the destroyer *Mohawk*, but two Ju 88As were lost to Spitfires of Nos. 602 and 603 Squadrons based at Turnhouse, including that of the *Gruppenkommandeur*, *Hauptmann* Pohle. On the following day, four Ju 88As led by the new *Gruppenkommandeur*, *Hauptmann* Doench, attacked Scapa Flow, damaging the old training battleship *Iron Duke*.

On December 1, 1939, II/KG 30 was activated at Barth, followed by III/KG 30 on January 1, 1940, and by the time Operation *Weserübung* was launched—the occupation of Denmark and Norway—on April 9, 1940, all three *Gruppen* of KG 30 were operational with a strength of 84 Ju 88As, although only 47 of these were serviceable at Westerland, these being used in an attack on British naval units off Bergen on the following day in concert with the He 111s of KG 26, the destroyer *Gurkha* being sunk, and the cruisers *Devonshire*, *Glasgow* and *Southampton* receiving damage. During the opening phase of the campaign, KG 30 remained at Westerland, but it was later dispersed at Oslo, Stavanger and Trondheim, the latter serving also as the base for the so-called *Zerstörerstaffel*/KG 30 which operated five Ju 88s and 10 Bf 110Cs. By this time, the first Ju 88D reconnaissance aircraft had entered service with 1.(F)/122 at Stavanger, this unit operating six Ju 88Ds and six He 111Hs.

The second *Geschwader* to convert to the Ju 88A was KG 51 which had previously operated the He 111, two *Gruppen* having completed conversion by May 10, 1940, when the assault on the West began. Almost simultaneously, *Lehrgeschwader* 1 and *Kampfgeschwader* 4 had initiated conversion, but only one of the two *Gruppen* of the former and one of the three *Gruppen* of the latter had converted in time for the onslaught, and the Ju 88A *Gruppen* played a relatively small part in the invasion of France and the Low Countries, the brunt of the bombing being borne by He 111s, although Ju 88As of LG 1 and KG 30 based at Düsseldorf and in the Netherlands respectively did undertake a number of bombing sorties against shipping off Dunkirk on May 29th. However, the first major action in which the Ju 88 was to participate was the "Battle of Britain".

On *Adlertag*, August 13, 1940, all three *Gruppen* of KG 51 had completed conversion to the Ju 88A, as had both *Gruppen* of LG 1, but KG 4 still possessed only one Ju 88A-equipped *Gruppe*. The I and II *Gruppen* of KG 54 had converted with III *Gruppe* still in process of conversion, and the III *Gruppe* of KG 1 had also converted to the Ju 88A. Several additional *Staffeln* had converted to the Ju 88D for long-range reconnaissance, these being 1.(F)/120, 1.(F)/121, 3.(F)/122 and 3.(F)/123. The *Luftflotte* 2 included the Ju 88s of III/KG 1 under I *Fliegerkorps*, III/KG 4 under IX *Fliegerdivision*, which also included the *Stab* of KG 40 which had been issued with the Ju 88A upon its formation during the previous month, *Stab*, I, II and III/LG 1 under IV *Fliegerkorps*, and *Stab*, I, II and III/KG 51 and *Stab*, I and II/KG 54 under V *Fliegerkorps*.

Highlights of the activities of the Ju 88A during the "Battle" included the mass attack by 63 aircraft from three *Gruppen* of KG 51 and 54 on Portsmouth on August 12th, with 15 aircraft detached to bomb radar installations at Ventnor on the Isle of Wight, and, on August 15th, an unescorted attack by 50 Ju 88As from the three *Gruppen* of KG 30 on



The Ju 88A was widely used as a test bed, and the Ju 88A-5 illustrated above is seen in service as a BMW 003 turbojet test aircraft.

Driffield, a No. 4 Group bomber airfield. Four hangars and various buildings, together with about a dozen Whitley bombers, were destroyed in this latter operation, although six aircraft were lost to British fighters. On the same day LG 1, based on Orleans, despatched 12 Ju 88As of I/LG 1 against Middle Wallop and 15 from II/LG 1 against Worthy Down. The attack by I/LG 1 took the fighter base completely by surprise, and a number of Spitfires were destroyed on the ground, but only three aircraft of II/LG 1 found their target, and of the seven Ju 88As of 4./LG 1 participating in the operation all but two were shot down.

By January 1941, Ju 88 strength was as follows: (*Luftflotte* 2) KG 30 with 90 aircraft (43 serviceable) in process of transferring to Norway; (*Luftflotte* 3) II and III/KG 1 with 55 aircraft (15 serviceable), KG 76 with 83 aircraft (6 serviceable) in process of converting from the Do 17, KG 77 with 87 aircraft (36 serviceable), KG 51 with 77 aircraft (33

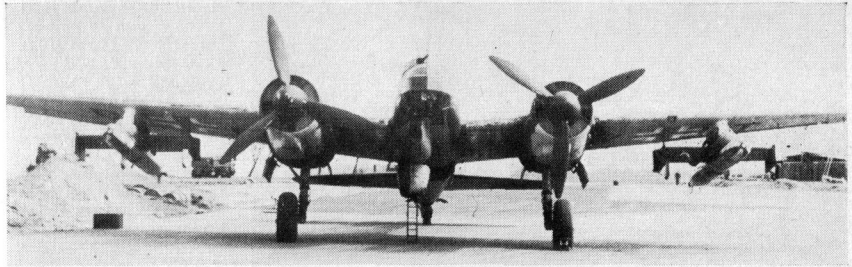
serviceable), KG 54 with 59 aircraft (33 serviceable), K.Gr.806 with 18 aircraft (12 serviceable), I/LG 1 with 21 aircraft (10 serviceable), and 3.(F)/121 with 11 aircraft (eight serviceable); (X *Fliegerkorps*) II and III/LG 1 with 77 aircraft, and 1.(F)/121 with 12 aircraft (10 serviceable) in transit from Norway to Sicily, and various Ju 88D-equipped long-range reconnaissance *Staffeln* in France, including 3.(F)/10, 3.(F)/11, 4.(F)/11, 4.(F)/14, and 1.(F)/120, and 3.(F)/22 in Norway.

The major Ju 88 operations of early 1941 were attacks on Malta carried out by KG 54, KG 77, LG 1 and K.Gr.806, later joined by K.Gr.606. These were further reinforced by III/KG 30, which, based in Sicily, carried out a wide range of sorties across the Mediterranean, attacking Piraeus harbour during the Greek campaign and, two days later, bombing Tobruk. The lion's share of Ju 88 action in the Mediterranean was to fall the lot of LG 1 which remained in the area until mid-1944. Between May 1941 and May 1942, this unit specialized in anti-shipping missions, its first major success coming on May 11, 1941, when four destroyers were sighted between Crete and Tobruk. Three sorties flown by I and II/LG 1 resulted in the sinking of three of the four vessels, the *Lively* and the *Kipling* breaking up and sinking during the attacks, and the *Jackal* sinking during the following morning after an attempt had been made to tow her to safety by the *Jervis*, the sole surviving destroyer. LG 1 also operated with good effect in North Africa in support of Rommel.

The *Luftwaffe* Order of Battle at the outset of the Russian campaign on June 22, 1941, included the following Ju 88-equipped units: (*Luftflotte* 1) II and III/KG 1 with 59 aircraft (56 serviceable), KG 76 with 90 aircraft (69 serviceable), KG 77 with 91 aircraft (67 serviceable), and 5.(F)/122; (*Luftflotte* 2) I and II/KG 3 with 82 aircraft (68 serviceable) and I(F)/122; (*Luftflotte* 4) KG 51 with 92 aircraft (81 serviceable), I and II/KG 54 with 71 aircraft (65 serviceable), 3. and 4.(F)/121 and 4.(F)/122, and (*Luftflotte* 5) 6./KG 30 with eight aircraft (six serviceable) and 1.(F)/120. In addition, the *Fliegerführer Ostsee* had K.Gr. 806 with 30 aircraft (18 serviceable), the bulk of the remaining Ju 88s on *Luftwaffe* strength being deployed on anti-shipping duties in the West.

The first major attack of the Russian campaign after the immediate onslaught on the first-line Soviet defences was a sortie against Moscow by some 130 aircraft, including Ju 88s of KG 3 and KG 54 on July 22, 1941, but the most famous of the Russian theatre operations was the series of attacks on Arctic convoys by the Ju 88s of KG 30 in concert with the He 111Hs of KG 26. The first of these convoys to suffer major air attack was PQ.13 which lost two ships to III/KG 30 at the end of March 1942. Between May 25th and 30th, KG 30 put up over 100 Ju 88s against PQ.16, this enormous effort resulting in only seven vessels being sunk, but the next convoy, PQ.17, suffered complete disaster, being scattered by a succession of air attacks between July 4th and 10th. Of the 23 vessels sunk almost half were victims of aerial attack.

Ju 88s participated to a limited extent in the anti-shipping campaign in the Atlantic, K.Gr.606 operating from Brest, and reconnaissance being undertaken by 3.(F)/123 from Lannion, Brittany, and early in 1943 the Ju88 began to appear in service with Germany's allies. In March 1943, crews from the Finnish Air Force's bomber unit P/LeLv 44 arrived in Germany to convert to the Ju 88A-4, ferrying 23 ex-*Luftwaffe* aircraft of this type back to Finland during April and May, one aircraft being lost *en route*. The Soviet offensive of June 1944 found P/LeLv 44 based at Onttola



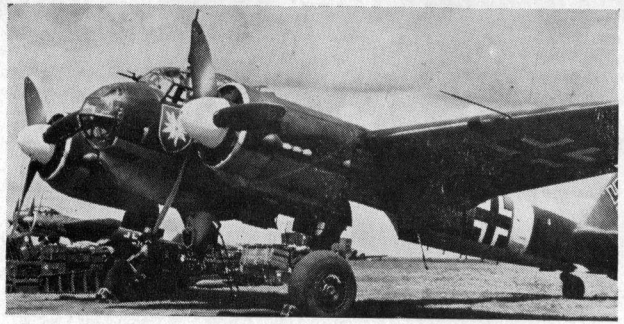
The Ju 88 participated in numerous experimental programmes, the aircraft illustrated above being a Ju 88A-4 with two L 10 torpedoes.

with 14 Ju 88A-4s, these subsequently seeing continuous action in support of Finnish forces retreating up the Karelian Isthmus until the acceptance of Soviet peace terms on September 4, 1944. Shortly afterwards, the Ju 88s of P/LeLv 44 were employed in harassing the German forces retreating from Finland, high attrition resulting from anti-aircraft fire.

Another recipient of ex-*Luftwaffe* Ju 88A-4s early in 1943 was the *Regia Aeronautica*, a total of 52 being delivered, including a number of Ju 88D-1 reconnaissance aircraft which equipped a strategic reconnaissance squadron of the 9° *Stormo*. The Ju 88A-4s were issued to the 51° *Gruppo Bombardamento Terrestre*, but this unit was still in process of conversion at Viterbo when, on September 8, 1943, Italy capitulated. The Royal Rumanian Air Force received sufficient Ju 88A-4s to equip the three squadrons of the 5th Bomber Wing which, forming a component of the Royal Rumanian 1st Air Corps, was based at Zaporozh'ye in the summer of 1943, the 2nd Squadron of the Long-Range Reconnaissance Wing operating Ju 88D-1s. The Ju 88A-4s of the 5th Bomber Wing were subsequently to be employed against German forces in the fighting in the vicinity of Klausenburg after the Rumanian *coup d'état* of August 23, 1944. The 4/III Bomber Group of the Hungarian Air Force also operated Ju 88A-4s on the Russian Front, Ju 88D-1s being employed by the I Long-Range Reconnaissance Squadron.

The fate of the *Luftwaffe's* principal Ju 88-equipped units during the final phases of the war in Europe was as follows: LG 1 remained in the Mediterranean theatre of operations, participating in the fighting in Italy until, in June 1944, it was transferred to Belgium to oppose the Normandy landings. There followed bitter rearguard fighting until the final collapse when the unit was based in Schleswig-Holstein. LG 1 was the only Ju 88-equipped bomber unit not to see action in Russia.

KG 1 was transferred to the Balkans and Italy after participating in the opening campaigns in the Soviet Union, and was finally disbanded during the summer of 1944.



A Ju 88A-4 of KG 51 which began to convert from the He 111 early in 1940 and eventually re-equipped with the Me 410 in 1943.

KG 3 remained in the Soviet Union until early 1944. III/KG 3 subsequently reverted to He 111Hs for the aerial launching of Fi 103 missiles against Britain.

KG 6 formed in May 1942 operated mainly in the West until late 1944, by which time it had relinquished the Ju 88 in favour of the Ju 188.

KG 26 began to re-equip from the He 111H to the Ju 88 for anti-shipping tasks in the spring of 1944, remaining in Norway until the end of hostilities, by which time it was equipped with a mixture of Ju 88s and Ju 188s.

KG 51 began to relinquish its Ju 88s in April 1943, subsequently re-equipping with the Me 410.

KG 54 returned from the Soviet Union to the Western Front early in 1944, and participated to a limited extent in nocturnal attacks on the British Isles until disbanded during the following autumn.

KG 60 operated the Ju 88 in Scandinavia for a short period during the winter of 1942–43.

KG 66 operated a mixture of Ju 88s, Ju 188s and Do 217s on Pathfinder missions in the West.

KG 76 was transferred to Sicily to combat Allied landings after some months on the Russian Front. It returned to the Western Front in June 1944, eventually re-equipping with the Ar 234.

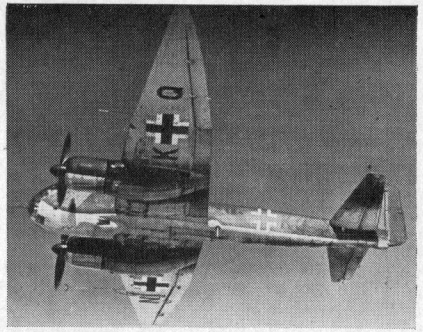
KG 77 operated on the Russian Front until the early summer of 1942 when it was transferred to Sicily, finally being disbanded in the winter of 1943–44.

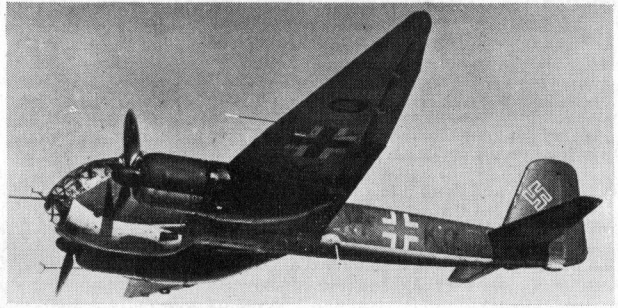
By early 1945, the Ju 88 equipped only a few long-range reconnaissance units, the remnants of the bomber force, and two night reconnaissance *Staffeln*, these units being *Fernaufklärungs-Gruppen* 2, 33, 122 and 124, *Kampfgeschwader* 26 and 66, *Lehrgeschwader* 1, and *Nachtaufklärungsstaffeln* 1 and 4. The Ju 88 had performed most of the tasks demanded of it with distinction, despite the fact that many of them were forced upon it by the needs of the overstrained and severely depleted German defences, and it may be claimed with justification that, had the Ju 88 not proved so amenable to adaptation, the *Luftwaffe* would have found itself in serious difficulties at a very much earlier stage in World War II.

JUNKERS JU 188 — GERMANY

From an early stage in the development of the Ju 88, the considerable "stretch" inherent in the basic design was obvious to the Technical Department at Dessau, but the success of the bomber in *Luftwaffe* service, coupled with the belief that the appreciably more advanced Ju 288 would be available from 1943, motivated against official enthusiasm for any major changes that would have enabled its full potential to be exploited. Thus, for more than three years, development of the Ju 88 was frozen, official sanction being obtained only for those modifications dictated by service experience or changing operational demands that could be applied without seriously impairing production deliveries.

By the late autumn of 1942, it had become obvious to the *Technische Amt* of the RLM that the service début of the Ju 288 would, at the best, be seriously delayed. A decision concerning an alternative successor to the Ju 88 in some of its multifarious roles was now a matter of extreme urgency. Fortuitously, despite meagre official encouragement, Junkers had persisted with the development of the Ju 88E as a low priority programme, conceivably considering this as an unofficial back-up for the "Bomber B".





The Ju 88 V44 (retrospectively designated Ju 188 V1) was the second Ju 188 development aircraft, the first being the Ju 88 V27.

Ju 188D-2s of 1. (F)/124 at Kirkenes, Norway. The Ju 188D-2 was intended primarily for the maritime reconnaissance role with FuG 200 Hohentwiel radar.

Progressive evolution of the Ju 88E-0 had resulted, in September 1941, in the **Ju 88 V27** (D-AWLN) which, powered by two BMW 801MA air-cooled radial engines, possessed an essentially similar airframe to that of the Ju 88E-0 apart from extended wingtips and ailerons, overall span being increased from 65 ft. 7½ in. to 72 ft. 2 in., and introduced a new low-drag EDL 131 dorsal turret mounting a single 13-mm. MG 131 machine gun. During the spring of 1942, development had been taken a further stage forward with the **Ju 88 V44** (NF-KQ), which, although essentially similar to its predecessor, the V27, embodied redesigned and enlarged vertical tail surfaces and an extended tailplane, these having been adopted to rectify some instability suffered by both the Ju 88E-0 and the Ju 88 V27.

The Ju 88 V44 was retrospectively designated **Ju 188 V1,** and with the decision taken in October 1942 to increase the development priority allocated to this Ju 88 derivative, a second prototype, the **Ju 188 V2**, was ordered, this being completed and joining the test programme in January 1943. Both prototypes were intended for both level- and dive-bombing featuring similar slatted dive brakes and automatic pull-out gear to the Ju 88A-4, and while tooling for the Ju 188 was being prepared at Bernburg, the RLM finalised its requirements, these including a demand that the aircraft should be capable of accepting interchangeable Jumo 213 or BMW 801 "power eggs" without any changes to the engine bearers, thus minimizing the risk of delivery delays resulting from bottlenecks in the supply of engines. It was intended that models with the two power plants should be manufactured simultaneously on the same assembly lines, quantities of each version being dictated by engine availability.

The first three aircraft were delivered from the Bernburg assembly line in February 1943, followed by seven in March and eight in April, and during the early summer the *Erprobungskommando d.Lw.* 188 was formed on the Ju 188 for service testing and development purposes, this test unit eventually becoming 4./KG 66. The first operational *Gruppe* to convert to the new bomber was I/KG 6 which, by October 20, 1943, was operating on Pathfinder missions in the West under *Luftflotte* 3 alongside the Ju 88s of the other

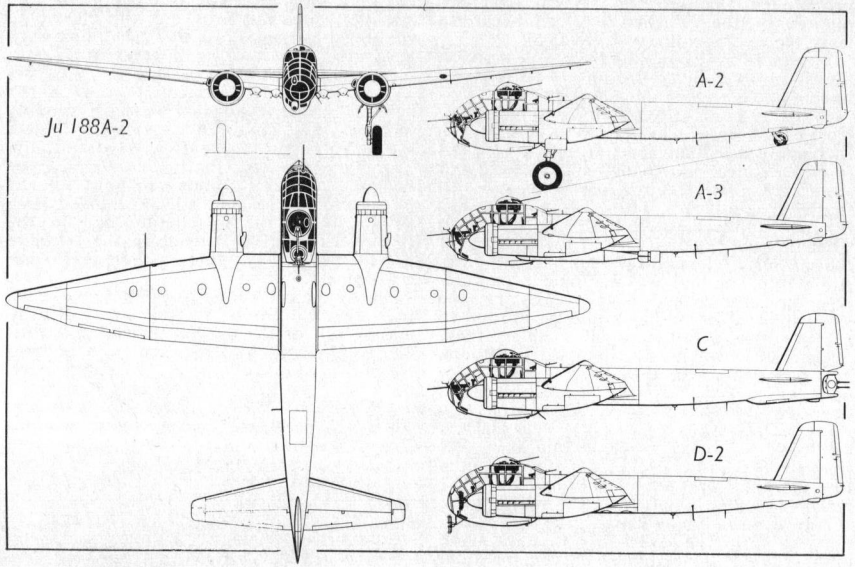
Gruppen, 28 aircraft being on strength of which 14 were operational.

A total of 283 Ju 188s had been accepted by the *Luftwaffe* from the Bernburg assembly line by the end of 1943, and at the beginning of 1944, both the ATG plant at Leipzig and the Siebel plant at Halle had been phased into the programme, the former delivering its first Ju 188 in January and the latter in February.

JUNKERS JU 188A

The preponderance of Ju 188s accepted by the *Luftwaffe* during 1943 were BMW 801-powered examples owing to the fact that this engine was more readily available than the Jumo 213, quantity production of which had still to get into its stride. Nevertheless, the first Jumo-powered pre-production **Ju 188A-0** bombers left the Bernburg factory almost simultaneously with the pre-production BMW 801-powered Ju 188E-0 bombers during the spring and early summer of 1943.

Powered by two Jumo 213A-1 engines rated at 1,776 h.p. for take-off and 1,600 h.p. at



18,000 ft., and driving Junkers VS 11 three-blade variable-pitch airscrews, the pre-production Ju 188A-0 was fitted with neither dive brakes nor automatic pull-out gear, being intended for the level bombing role, carrying up to 6,614lb. of bombs, this comprising up to 16 143-lb.SD 65 bombs internally and either four 1,102-lb. bombs or two 2,205-lb. bombs on the ETC racks beneath the wing centre section. The **Ju 188A-1** was intended to retain the dive-bombing equipment, but as this task was eliminated by the OKL, the proposed A-1 production version was supplanted by the **Ju 188A-2** which began to leave the assembly line early in 1944.

The Ju 188A-2 was, like the pre-production model, powered by two Jumo 213A-1 engines, but MW 50 (methanol-water) injection was provided to boost take-off power to 2,240 h.p. from each engine, maximum output at 15,500 ft. being 1,880 h.p. Apart from the forward fuselage, outer wing panels and vertical tail surfaces, the airframe was basically similar to that of the Ju 88A-4. Two 33 Imp. gal. tanks for methanol-water were built into the wings which housed 183 Imp. gal. of fuel inboard of the engine nacelles and 187 Imp. gal. outboard. A 370 Imp. gal. tank was mounted in the fuselage, and for extended-range missions, the small internal bomb-bay could be utilized to accommodate a 110 Imp. gal, auxiliary tank.

Defensive armament comprised a 20-mm. MG 151 cannon in the electro-hydraulically operated dorsal turret, a similar weapon operated by the bombardier projecting through the starboard side of the nose glazing, a 13-mm. MG 131 machine gun firing aft from the rear of the cockpit glazing above the fuselage, and a pair of 7.9-mm. MG 81 machine guns firing aft from the ventral step.

A torpedo-bombing variant, the **Ju 188A-3**, differing from the A-2 solely in having the outboard racks beneath the wing centre section deleted, was produced in small numbers. The Ju 188A-3 carried a pair of 1,764-lb. LT 1B or 1,686.5-lb. LT F5b torpedoes under the wing, a long bulged housing on the starboard side of the nose containing the equipment for adjusting the steering mechanism of the torpedoes. FuG 200 *Hohentwiel* radar was mounted in the nose.

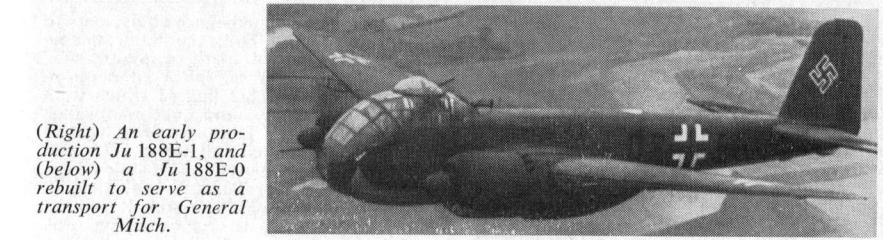
Prior to the establishment of the Ju 188 in series production, Junkers had proposed the use of the MG 131Z/FA 15 remotely-controlled tail barbette mounting a vertically-disposed pair of 13-mm. MG 131 machine guns. This barbette, which was provided with 600 r.p.g., was aimed by means of a PVE 11 double periscope, the guns having a traverse of 60°, elevation and depression being ± 45°. This barbette was mounted experimentally in an A-series airframe which, with rear fuselage suitably reinforced and outboard wing tanks deleted, was flown as the **Ju 188C-0**. Hydraulically-operated, the FA 15 barbette suffered from the complexity and poor reliability of the remote control system, which, coupled with the weight of the installation, led to the shelving of plans to introduce the barbette on the assembly line pending further development.

During the early months of 1944, by which time the Bernburg factory was already phasing out of the Ju 188 programme, production emphasis had changed from bomber to reconnaissance variants of the aircraft, those based on the Ju 188A being designated **Ju 188D-1** and **D-2**. The forward-firing 20-mm. MG 151 cannon was deleted, the crew complement was reduced to three members, and with maximum internal fuel plus drop tanks beneath the wing centre section, the Ju 188D took-off at a loaded weight of 33,500 lb. to attain a maximum range of 2,110 miles at 298 m.p.h. at 19,700 ft., maximum speed being 335 m.p.h. at 20,300 ft.

Several alternative camera installations were available, two Rb 50/30 or 75/30 being carried for reconnaissance missions by day, and two NRb 40/25 or 50/25 cameras being carried for nocturnal missions. The Ju 188D-2 was intended primarily for the maritime role, carrying FuG 200 *Hohentwiel* radar.

JUNKERS JU 188E

The E-series versions of the Ju 188 actually preceded the A-series into *Luftwaffe* service owing to the ready supply of BMW 801 engines by which they were powered. The pre-production **Ju 188E-0**, unlike the Ju 188A-0, retained slatted dive brakes hinged beneath the forward wing spar, as did also some early Ju 188E-1 production models, and was powered by two BMW 801ML engines which differed from the BMW 801MA engines of the prototypes solely in the type of airscrew control fitted. These were rated at 1,600 h.p. for take-off and 1,380 h.p. at 15,100 ft., and offensive load was similar to that of the Ju 188A, but defensive armament differed in that the dorsal turret mounted a 13-mm. MG 131 in place of the 20-mm. weapon.



(*Right*) *An early production Ju* 188E-1, *and* (*below*) *a Ju* 188E-0 *rebuilt to serve as a transport for General Milch.*

The first production Ju 188E-1 (*Werk-Nr.* 10 001) *which began to enter service in* 1943.

The **Ju 188E-1** was similar to the pre-production model, and was also powered initially by the BMW 801ML, but this version of the engine was replaced early in the production life of the bomber by the BMW 801D-2 or G-2 rated at 1,700 h.p. for take-off and offering 1,440 h.p. at 18,700 ft. The **Ju 188E-2** was a torpedo-bomber version equivalent to the Ju 188A-3, and some examples of this model were delivered to operational units without the EDL 131 dorsal turret.

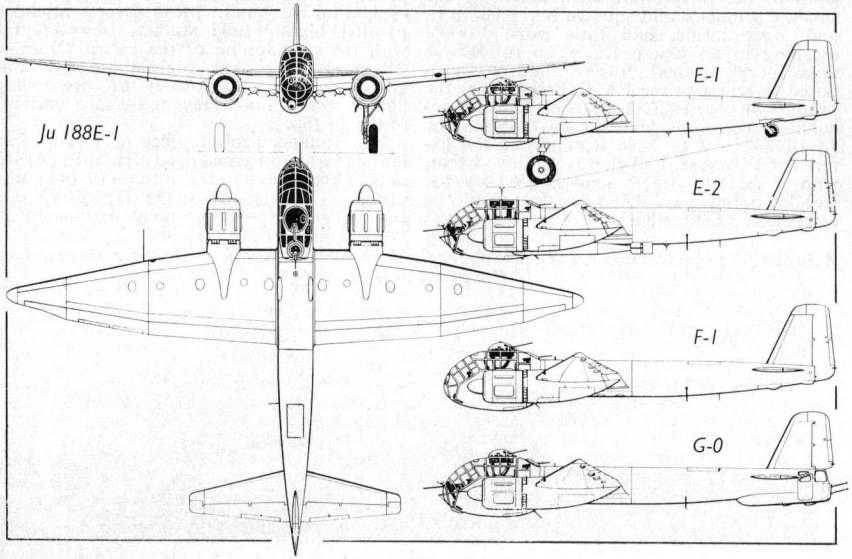
The **Ju 188F-1** and **F-2** were BMW 801D-2 or G-2-powered reconnaissance equivalents to the Ju 188D-1 and D-2, the latter having *Hohentwiel* radar for maritime operations, and two other BMW 801-powered developments were the Ju 188G and H which were respectively bomber and reconnaissance models featuring a large wooden ventral pannier and a manned tail turret. The insufficiently advanced development state of the FA 15 remotely-controlled tail barbette had led Junkers to consider a manned position in the tail in order to remove what was generally considered to be the most serious

JUNKERS JU 188A-2 SPECIFICATION

Type: *Four-seat Medium Bomber.* **Power Plants:** *Two Junkers Jumo* 213*A*-1 12-*cylinder liquid-cooled engines rated at* 1,776 *h.p. for take-off and* 1,600 *h.p. at* 18,000 *ft., or (with MW* 50 *injection)* 2,240 *h.p. for take-off and* 1,880 *h.p. at* 15,500 *ft.* **Armament:** (*Defensive*) *One* 20-*mm. MG* 151 *cannon in fuselage nose, one* 20-*mm.* 151 *cannon in power-operated dorsal turret, one* 13-*mm. MG* 131 *machine gun firing aft above fuselage, and two* 7.9-*mm. MG* 81 *machine guns firing aft below fuselage.* (*Offensive*)*Maximum bomb load of* 6,614 *lb. Typical loads comprised* 20 154-*lb., six* 551-*lb., four* 1,102-*lb. or two* 2,205-*lb. bombs.* **Performance:** *Maximum speed,* 264 *m.p.h. at sea level,* 323 *m.p.h. at* 19,685 *ft.; economical cruising speed,* 248 *m.p.h. at* 19,685 *ft.; range (with* 3,307-*lb. bomb load),* 1,490 *mls.; time to* 20,000 *ft.,* 17 *min.; service ceiling,* 31,170 *ft.* **Weights:** *Empty equipped,* 21,825 *lb.; normal loaded,* 31,967 *lb.* **Dimensions:** *Span,* 72 *ft.* 2 *in.; length,* 49 *ft.* 0½ *in.; height,* 14 *ft.* 7 *in.; wing area,* 602.778 *sq. ft.*

JUNKERS JU 188E-1 SPECIFICATION

Type: *Four-seat Medium Bomber.* **Power Plants:** *Two BMW* 801*D*-2 14-*cylinder radial air-cooled engines each rated at* 1,700 *h.p. for take-off and* 1,440 *h.p. at* 18,700 *ft.* **Armament:** (*Defensive*) *One* 20-*mm. MG* 151 *cannon in fuselage nose, one* 13-*mm. MG* 131 *machine gun in EDL* 131 *dorsal turret, one* 13-*mm. MG* 131 *machine gun firing aft above fuselage, and two* 7.9-*mm MG* 81 *machine guns firing aft below fuselage.* (*Offensive*) *Maximum bomb load of* 6,614 *lb. Typical loads comprised* 20 154-*lb., six* 551-*lb., four* 1,102-*lb., or two* 2,205-*lb. bombs.* **Performance:** *Maximum speed,* 310 *m.p.h. at* 19,685 *ft.; normal cruising speed,* 233 *m.p.h. at* 16,400 *ft.; climb to* 20,000 *ft.,* 17.6 *min.; service ceiling,* 30,665 *ft.; range (with* 4,410-*lb. bomb load),* 1,210 *mls.* **Weights:** *Empty equipped,* 21,737 *lb.; normal loaded,* 31,989 *lb.* **Dimensions:** *Span,* 72 *ft.* 2 *in.; length,* 49 *ft.* 0½ *in.; height,* 14 *ft.* 7 *in.; wing area,* 602.778 *sq. ft.*



shortcoming in the defensive system of the Ju 188, a blindspot immediately behind the tail. This manned turret, which mounted two MG 131s arranged in a similar fashion to those of the FA 15 barbette, had been tested on a Ju 88A-4, and the Ju 188 V2 was adapted to participate in this programme. The rear fuselage was deepened and strengthened in a similar fashion to that of the Ju 188C-0, and the aircraft was redesignated **Ju 188G-0**.

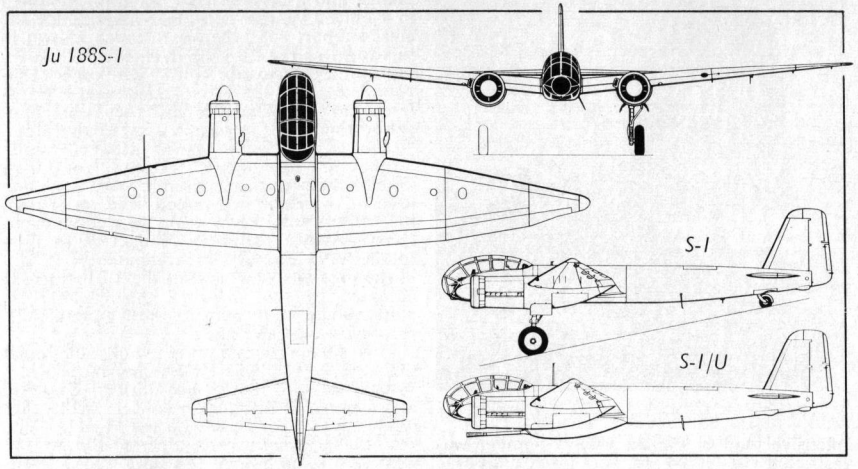
The manned turret possessed strict limitations. Traverse, elevation and depression of the guns was poor, and the internal dimensions of the turret were such that only the smallest gunner could squeeze himself into it, and, once inside, had little possibility of escaping in an emergency. The turret was unacceptable to the *Luftwaffe*, and it was proposed to revert to the FA 15 barbette for the production **Ju 188G-2** bomber and its reconnaissance equivalent, the **Ju 188H-2**. The Ju 188G-2 was to have relinquished the external ETC racks, and it was estimated that, with a 7,275-lb. bomb load housed by the wooden pannier, a 1,490-mile range would be attainable. Estimated maximum speed was 336 m.p.h. at 20,300 ft., but both the G- and H-models were overtaken by development of the Ju 388, neither being flight tested.

FURTHER DEVELOPMENT

Early in 1944, a night fighter derivative of the Ju 188E was produced under the designation **Ju 188R-0**. Powered by two BMW 801G-2 engines, equipped with centimetric radar and mounting a forward-firing armament of either four 20-mm. MG 151 cannon or two 30-mm. MK 103 cannon, the Ju 188R-0 proved to offer no major advantage over the Ju 88G, and production was therefore limited to three evaluation machines. More success attended parallel high-altitude studies, however, for with the abandoning of the entire "Bomber B" programme, the highest priority was allocated the development of pressurized fighter, bomber and reconnaissance variants of the Ju 188.

The Junkers project office at Dessau had initiated work on pressurized high-altitude variants of the Ju 188 in the autumn of 1943, and proposals were made to the *Technische Amt* for a *Zerstörer* provisionally designated Ju

A Ju 188E-2 torpedo-bomber. The bulge on the fuselage starboard side housed the steering mechanism adjustment gear.



188J, and bomber and reconnaissance versions respectively designated Ju 188K and Ju 188L. Considerable importance was attached to these developments by the RLM, and in September 1943, Junkers was instructed to proceed with these projects under the programme code-name *Hubertus*, the RLM electing to redesignate the three models Ju 388J, K and L. Instructions to proceed with two other proposed versions, the **Ju 188S** and **T**, were issued simultaneously, these being respectively fast high-altitude intruder and reconnaissance models which employed a similar redesigned and pressurized forward fuselage to that proposed for the Ju 388K and L but sacrificing all defensive armament, and relying solely on speed and altitude to evade interception.

Powered by two Jumo 213E-1 engines with three-speed two-stage superchargers and induction coolers, and GM-1 (nitrous oxide) injection, the Ju 188S and T employed an extensively-glazed three-seat cabin capable of maintaining a pressure differential of 3.7 lb./sq. in. The roof of the cabin was covered entirely by Plexiglass dry-air sandwich-type glazing, hygroscopic chemicals between the inner and outer panels preventing misting, and an armour bulkhead formed the rear of the cabin, a hatch in the starboard side of the floor providing access and egress for the crew. The Jumo 213E-1 engines with GM-1 injection at the "emergency" rate each provided 2,168 h.p. for take-off and 1,690 h.p. at 31,400 ft. The

The Ju 188 V2 with Ju 188G tail turret.

offensive load of the **Ju 188S-1** bomber was restricted to 1,764 lb. of bombs housed internally, and with GM 1 operating a maximum speed of 426 m.p.h. was attainable at 37,730 ft., while the somewhat lighter **Ju 188T-1** reconnaissance model with two Rb cameras reached 435 m.p.h.

Limited production of the Ju 188S-1 and T-1 was authorized, and the first Ju 188S-1 came off the ATG-Leipzig assembly line in the early summer of 1944. However, neither the Ju 188S or 188T was destined to be delivered to the *Luftwaffe* in quantity, no more than a handful of either model having left the assembly line when priorities changed once more, and most of the Ju 188S-1 airframes remaining on the line had all cabin pressurization and GM 1 equipment removed, armour protection added for both crew and power plants, and a 50-mm. BK 5 cannon mounted in a bulged ventral housing. Intended for the close-support role, the aircraft was known in this form as the **Ju 188S-1/U**, the "U" suffix indicating *Umbau* (Rebuild). Ten other semi-complete Ju 188S-1 airframes were transferred to Merseburg where they were converted to Ju 388L-0 reconnaissance aircraft.

The Ju 188 series never attained really large-scale production, despite the high opinion held of this aircraft by the *Luftwaffe* units to which it was issued, and more than half of the total production was confined to reconnaissance variants. Production in 1944 totalled 793 aircraft, as compared with 283 in the previous year, and of the 1,076 Ju 188s accepted by the *Luftwaffe* during 1943–44, approximately 570 were Ju 188D and Ju 188F reconnaissance aircraft.

Few *Kampfgruppen* were wholly equipped with the Ju 188, this type seeing more widespread use with the *Fernaufklärungs-Gruppen*, and even these using it in concert with other types, such as the Ju 88 and the Me 410. The first *Kampfgeschwader* to operate the Ju 188 was KG 6, although this unit never completely converted from the Ju 88, and some *Staffeln* of KG 26 and KG 66 re-equipped, other *Staffeln* of the same *Geschwader* retaining the Ju 88. One *Staffel* of I/KG 200 was operating Ju 188s during 1944 and the first months of 1945, and included in the mixed equipment of 1.*Staffel* of the *Versuchsverband Ob.d.L.* were at least two Ju 188s. By the beginning of 1945, *Fernaufklärungs-Staffeln* totally equipped with the Ju 188 included 3./FAGr.22, 3./FAGr.121, and 3. and 6./FAGr.122, while the Stab/FAGr.1 and elements of FAGr.3 were operating the Ju 188 alongside Me 410s, and FAGr.2, 1./FAGr. 120, 4./FAGr.122, 1./FAGr.124 and FAGr.33 were operating as mixed units with both Ju 88s and Ju 188s.

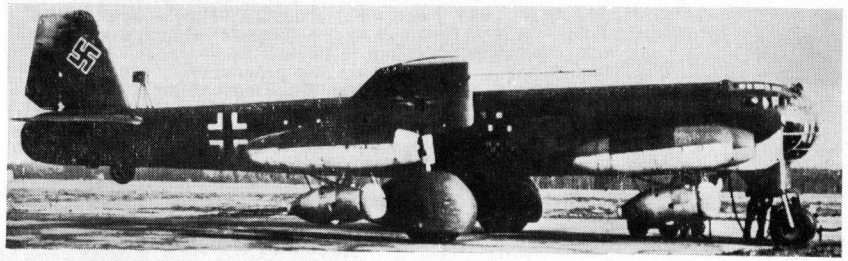
JUNKERS JU 287 — GERMANY

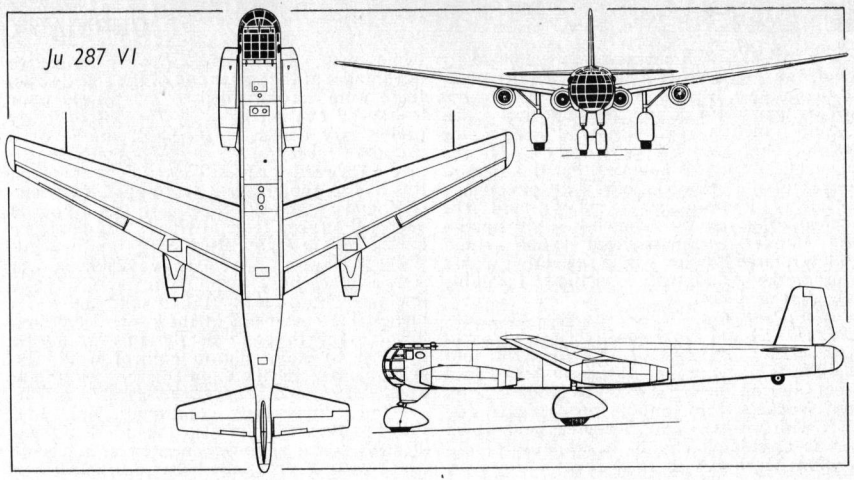
Early in 1943, a Junkers design team led by Dipl. Ing. Hans Wocke was allocated the task of designing a heavy bomber capable of higher speeds than those of any contemporary Allied fighter. Such a possibility had been made feasible by German development of the turbojet, and it was believed that this type of power plant, coupled with wing sweepback to delay compressibility effects and the critical drag rise by achieving aerodynamically thinner thickness-chord ratios, could endow a large bomber with a speed that would present the Allies with a virtually insoluble intercept problem.

The *Deutsches Versuchsanstalt für Luftfahrt* (DVL) and other research institutes had conducted a number of investigations into the effects of wing sweepback on high speed flight, and on the basis of these studies, Dipl. Ing. Wocke's team initially proposed an aircraft with wings swept 25 degrees and which it was calculated should be capable of exceeding Mach 0.8 in level flight. However, while wing sweepback offered impressive advantages at the upper end of the speed scale, these were accompanied by excessively poor low-speed characteristics. Thus, at an early preliminary design stage, Dipl. Ing. Wocke proposed reversing the wing configuration to give a forward- or negatively-raked planform, this having the effect, it was hoped, of transferring the stability problems to the opposite end of the speed scale at which they could be handled more easily. In theory, the forward-swept wing would have exactly the same effect as sweepback in reducing aerodynamically the thickness-chord ratio but would have its highest lift coefficient at the root, decreasing towards the tip, and as the tips would be the last to stall, aileron control would be available beyond the main centre-section flow breakaway.

Wind tunnel tests confirmed Dipl. Ing. Wocke's theories and also the disadvantages of this radical arrangement, the principle of which was its aeroelastic behaviour, but it was

The Ju 287 V1 was, to all intents and purposes, a flying mock-up of the bomber intended primarily to evaluate the low speed characteristics of the wing.

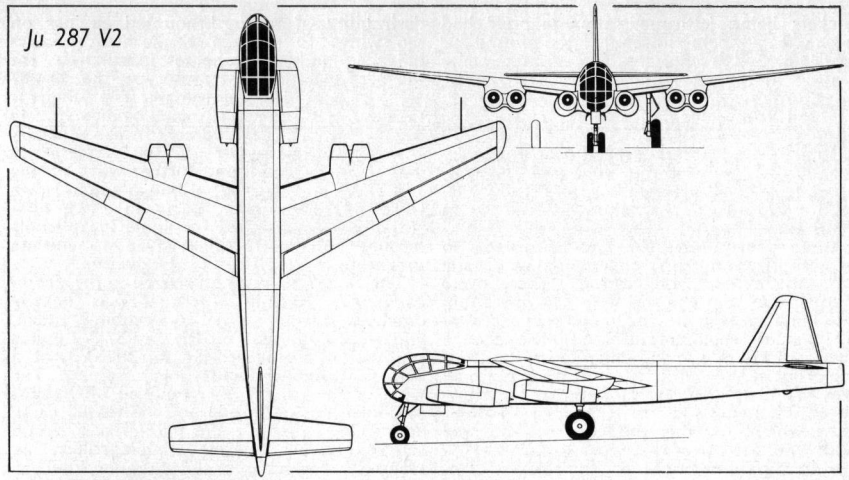




believed that this could be catered for in the course of design, and with the approval of the RLM's *Technische Amt*, detail design began under the designation Ju 287. However, so unconventional was the bomber that it was deemed advisable to evaluate the low-speed characteristics of the wing at full scale on a flying test-bed while design of the definitive bomber was finalised. In order to speed the test programme, it was decided to marry the wings to existing airframe components wherever possible. Thus, an He 177A fuselage was adapted for the task, its conversion being completed in April 1944 when mating with the new wings began. The tail assembly was made up from standard Ju 388 components, and since undercarriage stowage was not practicable in the forward-swept wing owing to its need for absolute structural

JUNKERS JU 287 V1 SPECIFICATION

Type: *Two-seat Aerodynamic Test-Bed.* **Power Plants:** *Four Junkers Jumo* 004*B*-1 *Orkan axial flow turbojets each rated at* 1,984 *lb. s.t.* **Performance:** *Maximum speed,* 347 *m.p.h. at* 19,685 *ft.; normal maximum cruising speed,* 318 *m.p.h. at* 22,965 *ft.* **Weights:** *Empty,* 27,557 *lb.; maximum loaded,* 44,092 *lb.* **Dimensions:** *Span,* 65 *ft.* 11¾ *in.; length,* 60 *ft.* 0½ *in.; wing area,* 656.598 *sq. ft.*



integrity, a massive fixed landing gear was adopted, this comprising twin nosewheel legs, the nosewheels themselves being salvaged from a B-24 Liberator, and main members braced to the forward wing spar and consisting of Ju 352 mainwheels enclosed by large fairings.

The mainplanes used a special Junkers reverse-camber high-speed aerofoil section with a two-spar all-metal structure. The inner wing leading edges were fitted with fixed slat sections to delay the initial root stall, and in addition to large slotted flaps extending down to 40 degrees, the ailerons were arranged to droop 23 degrees to provide a completely cambered wing for the maximum lift coefficients. Power was provided by four Jumo 004B turbojets of which two were attached to the sides of the forward fuselage and two were slung beneath the wing and attached to the rear spar.

Although only the wing of this test-bed bore any relationship to the definitive bomber, it was nevertheless designated **Ju 287 V1** (RS-RA), and the aircraft was transported from the Dessau factory to the Brandis airfield, near Leipzig, where it was flown for the first time on August 16, 1944 with *Flugkapitän* Siegfried Holzbauer at the controls. To provide additional thrust for take-off a 2,645 lb. thrust Walter 501 rocket pack was attached beneath each engine pod, these

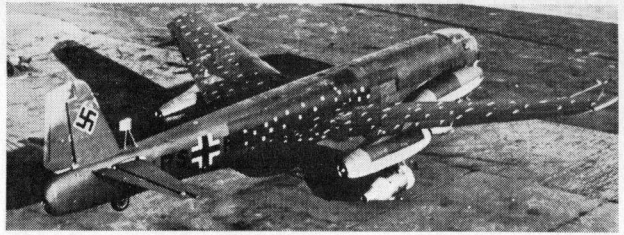
rockets being jettisoned after take-off had been effected, being lowered to the ground for retrieval and recharging, parachutes being stowed in the nose cone of each pack. A large braking chute could be deployed from the tail to reduce the landing run of the aircraft.

In all, 17 flights were made from Brandis by the Ju 287 V1 without untoward incident, apart from such diversions as the occasional failure of one of the temperamental Jumo 004B turbojets or the explosion of a Walter take-off rocket, and the aircraft proved to possess pleasant flying characteristics despite its unorthodox configuration. There were virtually no trim changes with flap operation, and landings even at wing loadings in excess of 60 lb./sq. ft. were uneventful, despite approach speeds of 150 m.p.h. and touch-down speeds of the order of 118 m.p.h. Most of the flight time was taken up with examination of the slow-speed characteristics of the forward-swept wing which, for this purpose, was covered with wool tufts over the upper surface so that the flow pattern could be analysed, a cine-camera being mounted on the aft fuselage immediately forward of the fin. The tufts confirmed the initial centre-section flow breakaway and its progressive outward spread, with a nosedown pitch only when it reached the ailerons. Lateral control remained good except when yaw was applied when a pronounced wing drop was experienced.

Despite the fact that the Ju 287 V1 was intended primarily for low-speed flying, it was dived with full power to a maximum of 404 m.p.h., this confirming the aeroelastic shortcomings of the wing arrangement, evidenced by decreasing elevator forces during tight turns and pull-outs from shallow dives, but otherwise the aircraft demonstrated faultless static longitudinal stability throughout its entire speed range. These tests revealed the desirability of forward-mounted engines on the wings to provide a mechanical mass balance, and the engine installation for the high-speed second prototype, the **Ju 287 V2**, was modified accordingly. The wing for the latter had been constructed by July 3, 1944 when bomber development was officially abandoned in favour of the "emergency fighter programme" and further work on the Ju 287 V2 was shelved, although some design work was continued. Early in 1945, construction was resumed for some inexplicable reason, and instructions given to initiate preparations for quantity production.

The Ju 287 V1 was transferred to the *Erprobungsstelle* Rechlin where it was heavily damaged during an Allied bombing attack, and work continued on the Ju 287 V2 and a production prototype, the **Ju 287 V3**, at a Junkers dispersal factory near Leipzig. The wing of the Ju 287 V2 remained unchanged in dimensions or profile but was mated to an entirely new fuselage and tail surfaces, and a fully-retractable tricycle undercarriage, all members of which were stowed in the fuselage. It was originally intended that the Ju 287 V2 would be powered by four 2,866 lb. s.t. Heinkel-Hirth 011A turbojets mounted in pairs and projecting forward of the wing leading edges, but owing to delays in the development of this power plant, Junkers elected to power both the V2 and V3 by six 1,760 lb. s.t. BMW 003A-1 turbojets, two arrangements being considered, the first envisaging a cluster of three engines beneath each wing and the second a pair of engines beneath each wing plus one on each side of the fuselage nose in the fashion of the Ju 287 V1. In the event, the latter arrangement was selected for the second and third prototypes and also for the pre-production **Ju 287A-0**.

Final assembly of the Ju 287 V2 had begun when the factory was overrun by Soviet



The Ju 287 V1 seen covered with wool tufts over wing and centre fuselage, a cine camera being mounted on the aft fuselage to record the flow pattern.

forces, and, allegedly, the incomplete prototype was removed to the Soviet Union, to where Dipl. Ing. Wocke was transported, together with a number of members of his team, the aircraft eventually being completed at Podberezhye where it was flown for the first time by *Flugkapitän* Dülgen in 1947. When Soviet forces occupied the factory, initial component construction had begun for the **Ju 287 V3** which was to have embodied full operational equipment, a pressure cabin in the nose for three crew members, and a tail barbette mounting two 13-mm. MG 131 machine guns and directed by means of periscopic sights from the crew compartment. One advantage of the forward-swept wing was the possibility that it offered of providing a large, continuous weapons-bay immediately ahead of the forward spar and approximately about the c.g. of the aircraft. This bay could house a maximum bomb load of 8,800 lb.

Whereas both the pre-production **Ju 287A-0** and initial production **Ju 287A-1** were to have been powered by six BMW 003A-1 turbojets, it was envisaged that the **Ju 287B-1** would receive four Heinkel-Hirth 011A-1 units and the **Ju 287B-2** would be powered by two 7,700 lb. s.t. BMW 018 engines, but neither B-model progressed further than advanced design studies.

JUNKERS JU 287 V3 SPECIFICATION

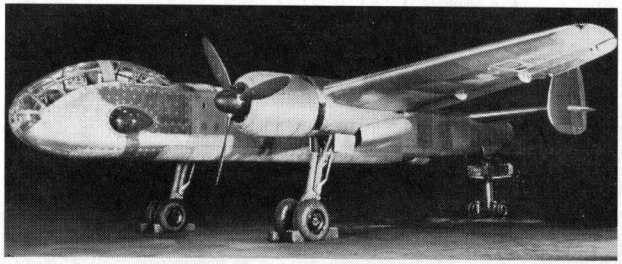
(Manufacturer's Estimated Figures)

Type: *Three-seat Heavy Bomber.* **Power Plants:** *Six BMW 003A-1 Sturm axial-flow turbojets each rated at 1,760 lb. s.t.* **Armament:** (*Defensive*) *Twin 13-mm. MG 131 machine guns in remotely controlled tail barbette.* (*Offensive*) *Maximum internal bomb load of 8,800 lb.* **Performance:** *Maximum speed (at 35,400 lb.), 509 m.p.h. at sea level, 537 m.p.h. at 16,400 ft., 487 m.p.h. at 36,100 ft.; maximum cruising speed (80% power), 447 m.p.h. at sea level, 493 m.p.h. at 23,000 ft.; range, 985 mls. with 8,800-lb. bomb load, 1,175 mls. with 6,600-lb. bomb load, 1,325 mls. with 4,400-lb. bomb load; time to 19,700 ft., 10.5 min., to 32,800 ft., 33 min.* **Weights:** *Empty equipped, 26,278 lb.; maximum loaded, 47,398 lb.* **Dimensions:** *Span, 65 ft. 11¾ in.; length, 61 ft. 0¼ in.; wing area, 656.598 sq. ft.*

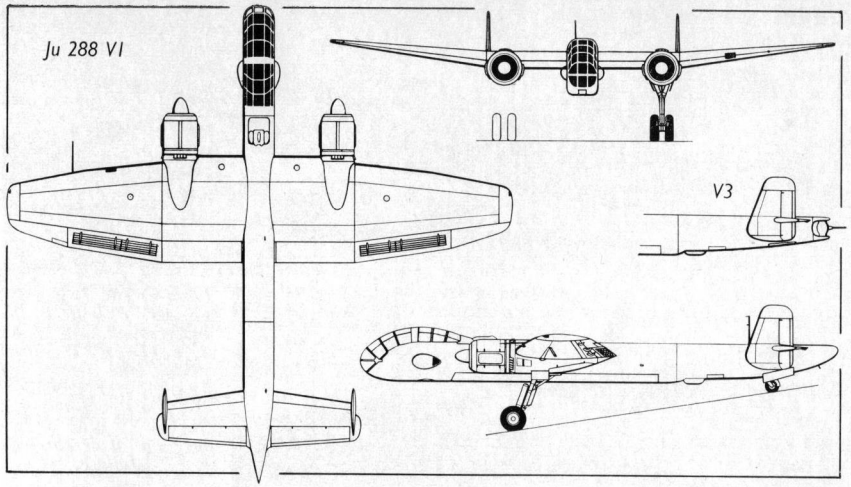
Created to provide an advanced successor to such warplanes as the Ju 88 and He 111, the "Bomber B" requirement was, when issued to the aircraft industry in July 1939, ostensibly to be fulfilled on a competitive basis, but from the outset it was apparent that the *Technische Amt* of the RLM favoured the Junkers organization above other competitors who could anticipate, at the best, nothing more than back-up contracts. This predilection on the part of the *Technische Amt* was not entirely surprising, however, in view of the fact that the "Bomber B" specification had been written around Junkers' EF 73 proposal which had already been submitted as a potential successor to the Ju 88.

The EF 73 proposal was the outcome of a series of design studies initiated as soon as plans for the quantity production of the Ju 88 had been formulated in the closing months of 1937, and envisaged pressurized crew accommodation and remotely-controlled defensive gun barbettes, features that were to be included in the "Bomber B" specification. Design development had attained an advanced stage by May 1939, when Dipl. Ing. Heinrich Hertel left Heinkel to become Junkers' Technical Director and Chief of Development, and with the *official* issue of the "Bomber B" requirement, the EF 73 proposal was modified under his direction and resubmitted to the *Technische Amt*.

As initially offered to the RLM, Junkers' "Bomber B" was a relatively small aircraft spanning only 51 ft. 6 in. and possessing an overall length of 52 ft. 10 in. The proposed power plants were two 24-cylinder Jumo 222 liquid-cooled engines or, alternatively, two Jumo 223s, the latter consisting of four Jumo two-stroke diesels with four crankshafts. Both Jumo 222 and 223 were expected to offer 2,500 h.p. for take-off, and to reduce drag it was proposed to employ the entire leading edges of the outer wing panels for surface evaporation cooling purposes. The three crew members were to be housed in a pressurized and extensively glazed nose section which was to feature lateral glazed blisters to provide aiming stations for the remotely-controlled dorsal and ventral twin-gun barbettes. Calculated maximum level speed was 416 m.p.h., maximum cruising speed



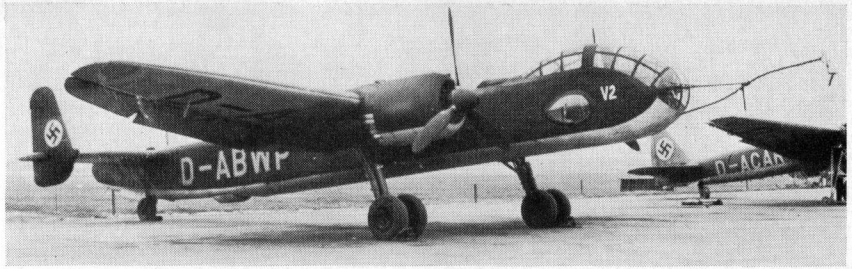
The Ju 288 V1 photographed at Dessau in the late autumn of 1940, prior to the initiation of ground trials.

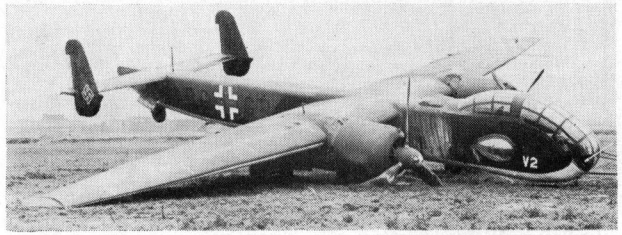


was estimated at 360 m.p.h. and service ceiling at 28,870 ft., and it was anticipated that the aircraft could carry a 6,614-lb. bomb load over a range of 1,678 miles and 1,100-lb. over 3,355 miles.

The *Technische Amt* was informed that if Junkers' proposals were accepted a prototype could be flown in October 1940, and that series production could commence by the beginning of 1942. However, although it had been the RLM's intention that the "Bomber B" specification should carry the state-of-the-art in medium bomber design a significant step forward, experience with other aircraft had already revealed something of the difficulties that were likely to be encountered with the surface evaporation system proposed by Junkers, the wing loading appeared unacceptably high, and it was the *Technische Amt*'s opinion that the Junkers team was being overly optimistic in its range calculations on the basis of the proposed fuel tankage. Hertel was, therefore, asked to modify the proposal to meet the RLM's objections.

Accordingly, a revised proposal was submitted, this having an enlarged wing spanning 60 ft. and possessing a gross area of 581.25 sq. ft., a slightly shorter fuselage with an overall length of 52 ft. 2 in., and the twin-gun dorsal and ventral barbettes replaced by single-gun barbettes projecting from the fuselage sides. After inspecting a mock-up





(Above) The Ju 288 *V*2 *(D-ABWP) with, in the background, the Ju* 88 *V*16 *(D-ACAR), used during the winter of* 1941–42 *for comparative trials, and (left) the Ju* 288 *V*2 *after suffering an undercarriage failure.*

of the crew compartment at Dessau in December 1939, the *Technische Amt* gave its approval to the commencement of detail design and the construction of a mock-up of the entire fuselage to include full instrumentation, control systems, armour and periscopic gun sights. This mock-up was inspected on May 29, 1940, and a few days later Junkers received an initial contract for three prototypes under the designation Ju 288.

JUNKERS JU 288A

Such was Junkers' confidence in obtaining a prototype contract for the new bomber that the first metal was cut on the **Ju 288 V1** in February 1940, nearly four months before the actual contract was received from the RLM, and in order to gain as much flight experience with certain design features as possible prior to the completion of the prototypes, Junkers decided to employ the **Ju 88 V2** (D-AREN) and the **Ju 88 V5** (D-ATYU) in the development programme. Two complete nose sections similar to that proposed for the Ju 288 were constructed and married to the airframes of the Ju 88 prototypes which were simultaneously fitted with Ju 288-type twin fin-and-rudder assemblies. Ducted spinners

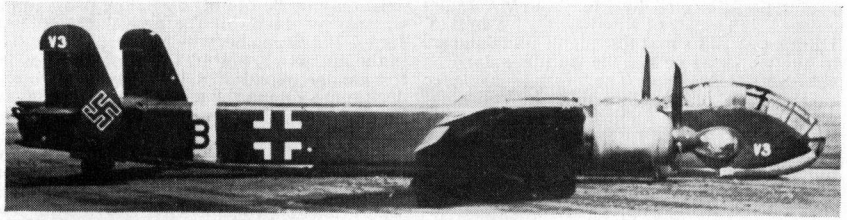
were fitted to the Jumo 211 engines, water condensers were introduced in the wing leading edges, and slatted-type dive brakes were incorporated in the outboard flaps.

Flight testing of the two modified Ju 88 prototypes was begun in the late spring of 1940 in the charge of *Flugkapitän* Holzbauer who was assisted by test pilots Joop and Preuschen. Test reports were generally favourable and comparison trials were performed with the slatted dive brakes and spoilers, the latter, which were referred to as the *Kamm-Unterbrecher* (Comb Interrupter), comprising a series of small horizontal strakes which were extended from the upper and lower wing panels at 35 per cent chord. As trials with the two forms of brake were indecisive, it was decided to delay a decision concerning this feature until both types of braking surface could be tested on the Ju 288 prototypes.

A static test airframe was tested to destruction at Dessau during the autumn of 1940, and late in January 1941, after protracted ground trials, the first prototype, the Ju 288 V1 (D-AOTF), was flown for the first time. As, sometime earlier, it had become obvious that the development of the Jumo 222 engine to flight status would be more protracted than envisaged at the time the "Bomber B" specification was framed, and the Jumo 223 having been abandoned at an early stage, the decision had been taken to power the first Ju 288 prototypes with BMW 801 14-cylinder radial air-cooled engines, these being the most powerful units readily available, and only slightly larger in diameter than the Jumo 222. The Ju 288 V1 was, therefore, powered by two BMW 801MA engines each rated at 1,600 h.p. for take-off and 1,380 h.p. at 15,100 ft. The defensive armament arrangement reverted to that of the original EF 73 proposal, dummy barbettes being mounted in forward dorsal and aft ventral positions, and the tail unit was fitted with fixed slats.

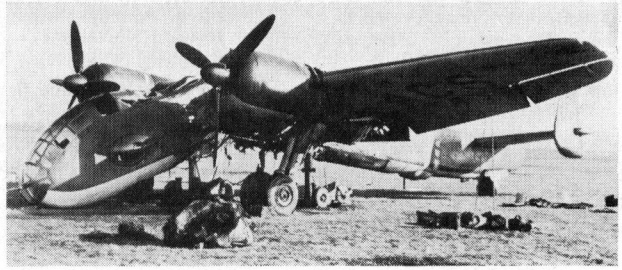
During the early spring of 1941, the first prototype was joined by the **Ju 288 V2** (D-ABWP) which differed from its predecessor only in having spoiler-type dive brakes in place of the slatted-type surfaces which were also featured by the **Ju 288 V3**, this third prototype commencing flight trials during the early summer, by which time work had begun on a further series of prototypes, the first of

The Ju 288 *V*3, *flown in the early summer of* 1941, *seen after an undercarriage failure during landing. This accident occurred after the fitting of the tail barbette.*



JUNKERS JU 288A SPECIFICATION
(Initial version based on Manufacturer's Estimates)

Type: *Three-seat Medium Bomber.* **Power Plants:** *Two Junkers Jumo 222A-1/B-124-cylinder liquid-cooled multi-bank radial engines each rated at 2,500 h.p. for take-off and 2,020 h.p. at 16,400 ft.* **Armament:** *One forward dorsal and one aft ventral remotely-controlled barbette each housing two 13-mm. MG 131 machine guns. (Offensive) Maximum bomb load of 6,614 lb. internally, comprising three 2,204-lb. bombs, three 1,102-lb. and six 551-lb. bombs, or 30 110-lb. bombs.* **Performance:** *Maximum speed, 416 m.p.h. at 19,685 ft.; range (with maximum bomb load), 2,235 mls. at 345 m.p.h. at 26,300 ft., (with maximum fuel), 3,720 mls. at 338 m.p.h. at 26,300 ft.* **Weights:** *Normal loaded, 33,850 lb.; maximum loaded, 38,900 lb.* **Dimensions:** *Span, 60 ft. 0 in.; length, 52 ft. 2 in.; wing area, 581.25 sq. ft.*

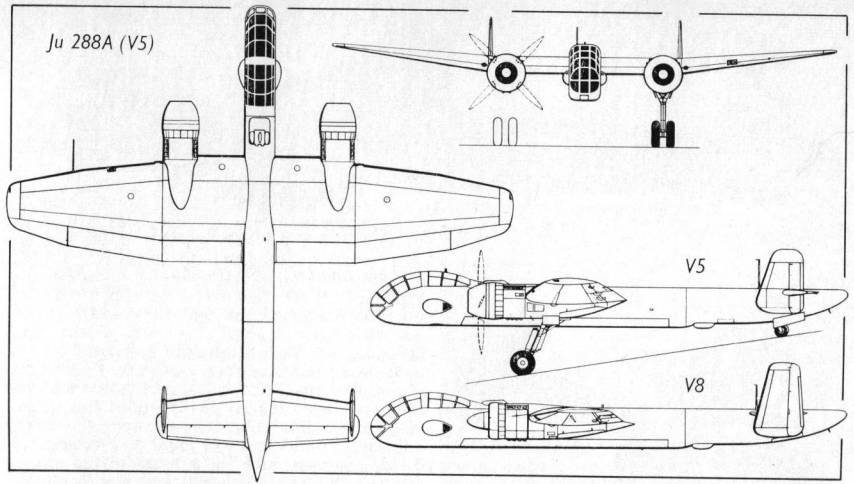


The Ju 288 V4 after suffering an engine fire which burned through the main fuselage longerons, virtually severing the nose.

these being the Ju 288 V4 (D-AACS).

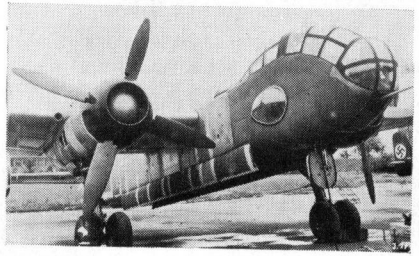
The **Ju 288 V4** was, like the three preceding prototypes, powered by BMW 801MA radial engines, but was not fitted with dive brakes. During one of its first test flights a fire started in the port engine nacelle during a landing approach at Dessau. The fire was so fierce that, during the landing run, it burned completely through the main longerons, virtually severing the forward fuselage from the centre fuselage. The aircraft was extensively damaged but was, nevertheless, rebuilt and resumed its flight test programme late in November, subsequently being employed to measure landing shocks, landing at weights up to 26,000 lb. at which wing loading was 45 lb./sq. ft.

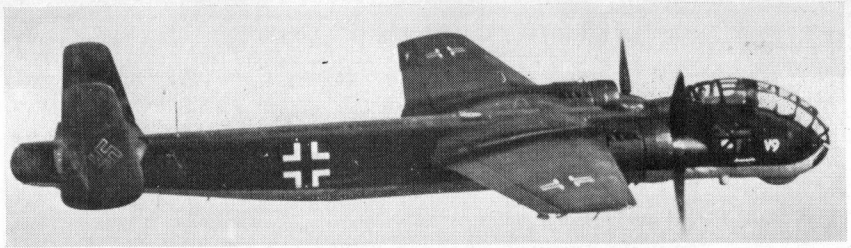
In the middle of July 1941, the programme was slowed to await the arrival of the first Jumo 222A/B engines which were to be installed in the **Ju 288 V5**, and by this time the demand for greater operational loads had led to the decision to extend the wing span. The span of the Ju 288 V2's wing had already been extended from 60 ft. to 66 ft. 3¼ in., wing area being raised from 581.25 to 635 sq. ft., and it was proposed that the A-series production model should have overall span and wing area increased still further to 72 ft. 2 in. and

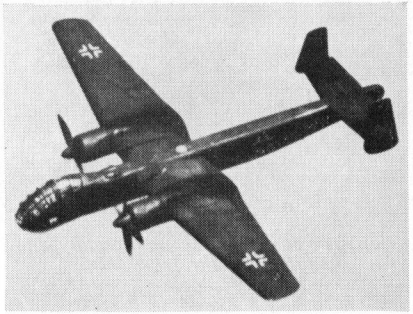


645.83 sq. ft. respectively. Two production versions were envisaged, the **Ju 288A-1** with large lateral sighting blisters and no periscopic gun sights, and the **Ju 288A-2** with shallower blisters and periscopic sights. Both versions were intended to carry three crew members, possess normal and maximum loaded weights of 37,920 lb. and 40,785 lb. respectively, and carry a maximum bomb load of 11,020 lb., and three production prototypes had been ordered, the Ju 288 V6, V7 and V8. The enlarged wing was to be accompanied by ailerons of new design, these having been tunnel-tested in March 1941, and plans called for Junkers to build up to a production tempo of 80 Ju 288A bombers per month, Arado, ATG,

(*Below*) *The Ju 288 V5, the first prototype to be fitted with the Jumo 222.*







(*Above and left*) *The Ju* 288 *V*9, *the first B-series prototype which featured the enlarged four-seat cockpit and Jumo* 222s.

Dornier, Heinkel, Henschel and Siebel plants being progressively phased into the programme to produce a further 300 aircraft per month. However, yet further changes in the requirements of the *Technische Amt*, including a demand for accommodation for four crew members, necessitated still further redesign, all plans for the production of the Ju 288A being abandoned in favour of the Ju 288B with a wider, four-seat cockpit and a completely redesigned wing of still greater span and area.

Delays in the delivery of the first flight-cleared Jumo 222s to Dessau prevented the completion of the Ju 288 V5 until the end of September 1941, this fifth prototype eventually taking-off on its first test flight on October 8th, being followed into the air before the end of the month by the similarly-powered **Ju 288 V6**. Whereas the V5 possessed a similar wing to that of the V1, the V6 was completed with the redesigned and enlarged wing intended for the Ju 288B series, this spanning 74 ft 4 in. and possessing an area of 696.42 sq. ft. The **Ju 288 V7**, which was not completed until the spring of 1942, was similar to the V6 but owing to the severe shortage of flight-cleared Jumo 222 engines was fitted with BMW 801C radials and, seriously underpowered, was soon grounded as a result of extensive damage caused by an engine fire. The third aircraft commenced as an A-series production prototype, the **Ju 288 V8**, left the assembly line shortly after the V7 but was powered by Jumo 222s and was fitted with the redesigned and

enlarged tail assembly intended for the Ju 288B, a similar tail later being fitted to the Ju 288 V7.

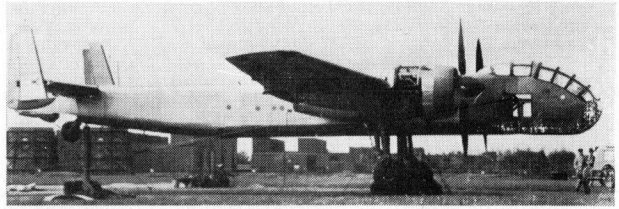
In the meantime, pressurization tests had been conducted with a complete Ju 288A nose section which was submerged and towed at high speed in the waters of Lake Trebbichau West of Dessau, and both the Ju 288 V2 and V3 had been used for undercarriage development purposes. From the outset of Ju 288 flight trials the shock-damping characteristics of the undercarriage had given considerable cause for dissatisfaction and constant modifications were applied. During the winter of 1941–42, a series of comparative trials were conducted on snow-covered runways with the Ju 288 V2 and the Ju 88 V16, the performance of the former proving entirely unsatisfactory and calling for yet further modifications. During October 1941, the Ju 288 V3 (BK-HS) had been tested with a specially reinforced undercarriage which displayed some improvement in characteristics, but undercarriage problems continued to plague the test programme.

During the summer of 1942, the Ju 288 V3 was modified by the introduction of a remotely-controlled tail barbette mounting a single 15-mm. MG 151 cannon, but shortly after this modification was made the aircraft was badly damaged when both undercarriage legs collapsed as the aircraft touched down after a test flight.

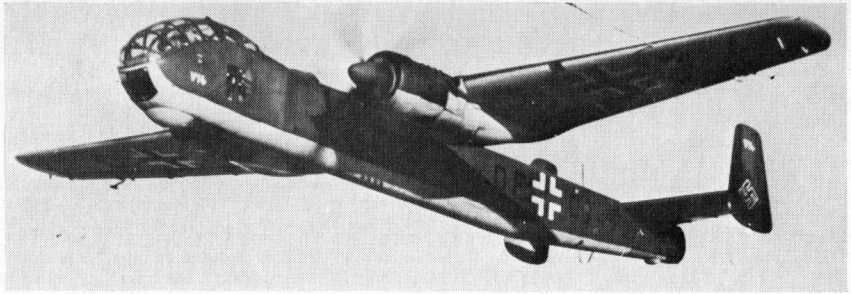
JUNKERS JU 288B

In September 1941, Junkers initiated preparations for the series production of the four-seat Ju 288B in place of the three-seat Ju 288A. The proposals submitted to and accepted by the *Technische Amt* called for the retention of the A-series centre and aft fuselage, these being married to a new and somewhat bulbous forward fuselage and the redesigned and enlarged wing that was awaiting flight testing on the Ju 288 V6. In order to restrict normal and maximum loaded weights to 39,022 lb. and 41,000 lb. respectively, despite substantial increases in structural and equipment weights that had resulted from the up-dated specification, it was necessary to reduce maximum bomb load to 6,614 lb. Defensive armament was intended to comprise twin 13-mm. MG 131 machine guns in forward dorsal barbette, a similar pair of weapons in a barbette beneath the extreme nose, and either a single 15-mm. MG 151 cannon or twin MG 131s in the extreme tail, all guns being controlled by means of upper and lower periscopic sights.

The RLM had issued Junkers with instructions to tool up for the commencement of series production of the Ju 288B in March 1942, but shortly after these intructions were



(*Right*) *The Ju* 288 *V*11, *the second B-series prototype and the first to have DB* 606 *engines.*



The Ju 288 V14 was the final B-series prototype which was flown in September 1942 with Jumo 222A/B engines.

issued a review of the Jumo 222 engine development situation revealed their lack of realism and, on November 1, 1941, the RLM's order was rescinded, and Junkers was instructed to restrict production to 35 aircraft pending a solution to the power plant problem.

The first B-series prototype, the **Ju 288 V9** (VE-QP) featuring the enlarged four-seat cockpit and Jumo 222 engines, was flown in May 1942. Dorsal and chin barbettes were fitted but these mounted no armament. The second B-series prototype, the **Ju 288 V11**, possessed a similar airframe to that of the V9 but was powered by Daimler-Benz DB 606A/B 24-cylinder liquid-cooled engines which were now being considered as alternatives to the

JUNKERS JU 288B SPECIFICATION
(Final version based on Manufacturer's Estimates)

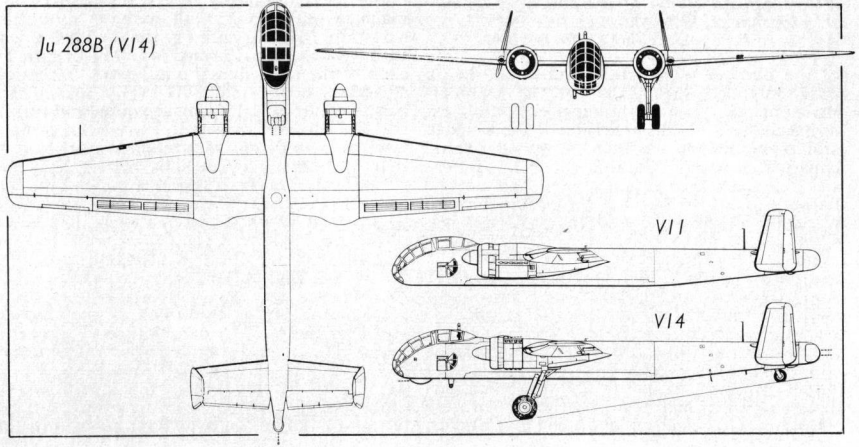
Type: *Four-seat Medium Bomber.* **Power Plants:** *Two Daimler-Benz DB 606A-1/B-1 24-cylinder liquid-cooled engines each rated at 2,700 h.p. for take-off and 2,360 h.p. at 19,030 ft.* **Armament:** *One forward dorsal and one chin remotely-controlled barbette each mounting two 13-mm. MG 131 machine guns and one 15-mm. MG 151 cannon or two 13-mm. MG 131 machine guns in remotely-controlled tail barbette. (Offensive) Maximum bombload of 6,614 lb. internally, comprising three 2,204-lb. bombs, three 1,102-lb. and six 551-lb. bombs, or 30 110-lb. bombs.* **Performance:** *Maximum speed, 387 m.p.h. at 17,700 ft.; range (with 1,162 Imp. gal. fuel and 6,614 lb. bomb load), 1,680 mls. at 295 m.p.h.; initial climb rate (at 46,200 lb.), 1,420 ft./min.; time to 13,120 ft., 10 min., to 19,685 ft., 16.5 min., to 26,250 ft., 27 min.; service ceiling (at 37,400 lb.), 30,500 ft.* **Weights:** *Maximum loaded, 46,200 lb.* **Dimensions:** *Span, 74 ft. 4 in.; length, 58 ft. 4¾ in.; wing area, 696.42 sq. ft.*

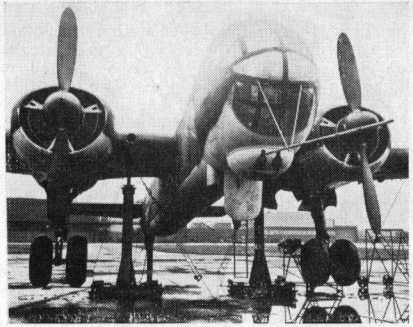
Jumos, despite their appreciably greater weight and size. The DB 606 compensated for its higher weight and larger dimensions by offering 2,700 h.p. for take-off and 2,650 h.p. at 15,800 ft. as compared with the Jumo 222's 2,500 h.p. for take-off and 2,200 h.p. at 16,400 ft. The Ju 288 V11 began ground testing in May 1942, and during the previous month, Junkers had received an order to prepare for the production of the Ju 288 within 10 months and as there was now little hope of the Jumo 222 being available in sufficient quantities by the time the bomber reached the assembly line, the designated power plant was the DB 606, or, if available in time, the DB 610.

The **Ju 288 V12** had meanwhile been completed, this being a Jumo 222-powered hybrid with a B-series airframe married to an A-series three-seat forward fuselage. The **Ju 288 V13**, the third B-series prototype with DB 606A/B engines completed in July 1942, was similar to the V9, and, in January 1943, was adapted for tests with an improved tail barbette mounting a single 15-mm. MG 151 cannon. The final B-series prototype, the **Ju 288 V14** (DF-CT), was completed in August 1942 with Jumo 222A/B engines and flown in September, but by this time Dipl. Ing. Hertel's team had abandoned further work on the Ju 288B in favour of the much-modified Ju 288C.

JUNKERS JU 288C

Prior to the receipt of RLM instructions to prepare for production of the DB 606-powered Ju 288, Dipl. Ing. Hertel had introduced some major changes in the basic design





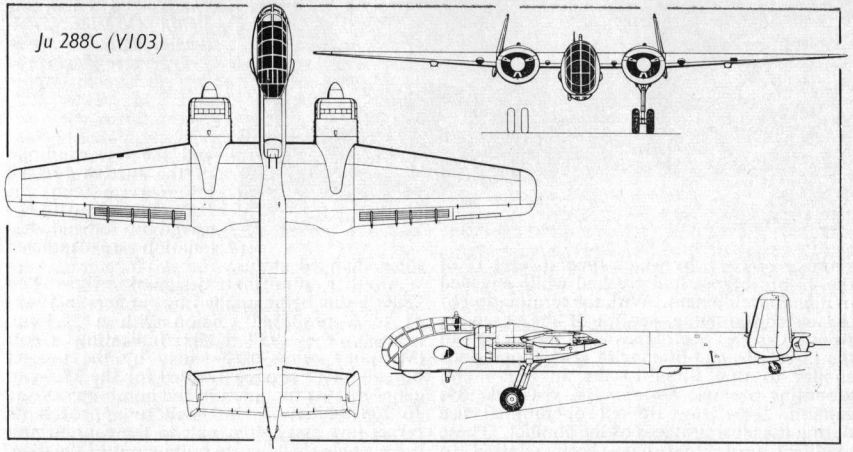
The Ju 288 V107 was completed and flown after the cancellation of the entire "Bomber B" programme, being flown in July 1943. It is seen here undergoing static testing.

of the bomber which had resulted in the Ju 288C intended specifically for the Daimler-Benz engines. One of the most noticeable external changes was the provision of a redesigned and elongated nose which increased overall length from 58 ft. 4¾ in. to 59 ft. 5¾ in. Defensive armament was supplemented by a ventral barbette aft of the bomb-bay, instrumentation was greatly improved and the structure was strengthened.

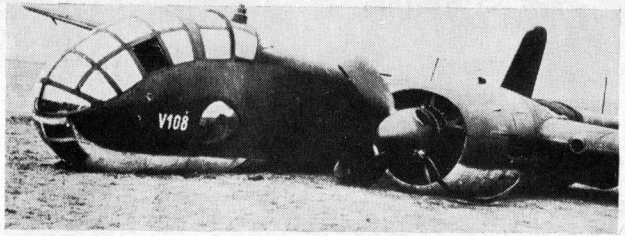
The first C-series prototype, the **Ju 288 V101** with DB 606A/B engines, was completed in August 1942, this being followed within a few weeks by the similar **Ju 288 V102**. Dipl. Ing. Hertel left Junkers to return to Heinkel in November 1942, but the Ju 288C programme continued with high priority, production standards were finalised, and modifications dictated by the flight test programme with the V101 and V102, such as reinforced dive brakes, together with proposed production features, were embodied by the next prototype, the Ju 288 V103 (DE-ZZ). Fitted with the more powerful DB 610 engines and introducing provision for underwing weapons racks, the **Ju 288 V103** had the full complement of four remotely-controlled gun barbettes, and was flown for the first time in the spring of 1943.

The Ju 288 V103 was intended as the first production prototype for the **Ju 288C-1**, and was rapidly followed by the **Ju 288 V104** and **V105** which were flown in May 1943, and the **V106** which flew in June, these all being powered by DB 610A/B engines and differing only in minor items of equipment. At this time, it was proposed to manufacture the bomber in three versions which differed primarily in the defensive armament fitted. The **Ju 288C-1** was to have had chin, dorsal and ventral barbettes each mounting twin 13-mm. MG 131 machine guns, and a tail barbette mounting a 15-mm. MG 151 cannon; the **Ju 288C-2** was to have had twin 15-mm. MG 151 cannon in each of the chin, dorsal and ventral barbettes, and either two 13-mm. MG 131s in the tail barbette or four MG 131s in a manned tail turret, and the **Ju 288C-3** was to have been a night bomber with defensive armament restricted to twin MG 131s in a ventral barbette.

Suddenly, in June 1943, Junkers was informed by the *Technische Amt* that the entire "Bomber B" programme had been abandoned owing to increasing shortages of strategic materials and the effect that the launching of a major production programme for a new bomber would have on existing production programmes at a critical phase in the conflict. However, despite the cancellation of the programme, Junkers completed two additional machines, the **Ju 288 V107** and **V108**, which were flown in July 1943, other airframes on the assembly line being scrapped. Some flight testing of the Ju 288 was continued until the



The Ju 288 V103 was intended as the production prototype for the Ju 288C-1.



The Ju 288 V108, the eighth C-series prototype completed with B-type nose glazing.

summer of 1944, by which time at least 17 of the 22 prototypes had crashed while engaged in flight development. With the termination of the test programme, several of the surviving B- and C-series prototypes were transferred to the *Luftwaffe*, and fitted with ventral gun pods similar to that fitted to the Ju 88P-4 and mounting a single 50-mm. BK 5 (KwK 39) cannon, these saw limited operational use during the closing stages of the conflict. These modified prototypes have been referred to erroneously in the past as the "Ju 288E", but this designation was, in fact, entirely spurious and the few examples of the Ju 288 pressed into service with the BK 5 cannon received no official designation to indicate their changed status.

Another unofficial designation was "Ju 288G", this being applied by Junkers in 1940–41 to a proposed version with a 35.5-cm. cannon, the "G" suffix indicating *Gerät* (Weapon) being used solely by the project bureau. This proposal called for the 35.5-cm. cannon to be mounted in the bomb-bay of the Ju 288 which was intended to approach its target in a steep dive, extend the cannon and fire a single shell before pulling out of the dive. This project progressed no further than the drawing board.

JUNKERS JU 288C-1 SPECIFICATION
(Based on Manufacturer's Estimates)

Type: *Four-seat Medium Bomber.* **Power Plants:** *Two Daimler-Benz DB* 610-1/**B**-1 *24-cylinder liquid-cooled engines each rated at* 2,950 *h.p. for take-off and* 3,100 *h.p. at* 6,890 *ft.* **Armament:** *Forward dorsal, chin and aft ventral remotely-controlled barbettes each mounting two* 13-*mm. MG* 131 *machine guns and one* 15-*mm. MG* 151 *cannon in remotely-controlled tail barbette.* (*Offensive*) *Maximum internal bomb load of* 6,614 *lb. plus* 4,409 *lb. on underwing racks.* **Performance:** *Maximum speed,* 407 *m.p.h. at* 22,300 *ft.; range* (*with* 1,162 *Imp. gal. fuel and* 6,614-*lb. bomb load*), 1,615 *mls. at* 317 *m.p.h.,* (*with* 773 *Imp. gal. fuel and* 11,023-*lb. bomb load*), 1,055 *mls. at* 315 *m.p.h.; initial climb rate* (*at* 47,120 *lb.*), 1,620 *ft./min.; service ceiling* (*at* 38,000 *lb.*), 34,000 *ft.* **Weights:** *Normal maximum loaded,* 47,120 *lb.; maximum overload,* 49,500 *lb.* **Dimensions:** *Span,* 74 *ft.* 4 *in.; length,* 59 *ft.* 5¾ *in.; wing area,* 696.42 *sq. ft.*

JUNKERS JU 290

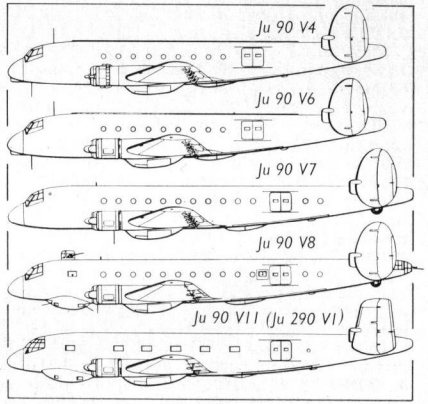
Few aircraft that saw operational service during World War II can have possessed a more unusual design background than the Ju 290 which, in its final long-range strategic bomber form, represented the full cycle in design evolution, having been developed from a commercial transport which had, itself, stemmed from a long-range strategic bomber.

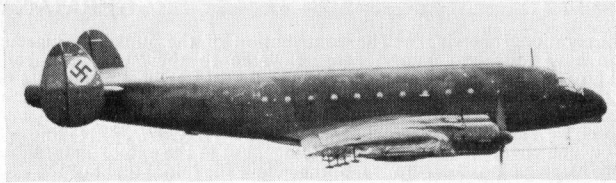
The design origins of the Ju 290 dated back to early 1935 and the so-called "Ural Bomber" concept of Lieut. General Wever, the *Luftwaffe*'s first Chief-of-Staff and an ardent protagonist of the long-range strategic bomber. The "Ural Bomber" concept was most certainly some years ahead of the contemporary political situation and, in some respects, the state-of-the-art insofar as the fledgeling German aircraft industry was concerned. Its opponents were numerous but, nevertheless, under the aegis of General Wever, both the Junkers and Dornier concerns initiated the development of four-engined long-range strategic bombers.

With Wever's accidental death on June 3, 1936, his successor, General Albert Kesselring, immediately began the reappraisal of the entire "Ural Bomber" programme, concluding that the smaller twin-engined bomber would suffice for any war such as was envisaged in Western Europe, with its implicit limitations on air strategy; that the primary role of the *Luftwaffe* must remain tactical rather than strategic, and that, in view of the limited capacity of the German aircraft industry at that time, the heavy strategic bomber could be produced only at the expense of more urgently-needed fighters and tactical bombers. Thus, despite some protests from the *Technische Amt* of the RLM, early in 1937 Kesselring finally forbade the further development of the "Ural Bomber".

The contribution of the Junkers Flugzeug und Motorenwerke to the "Ural Bomber" programme was the Ju 89, three prototypes of which had been under construction at Dessau. Two prototypes had been completed and flown, the **Ju 89 V1** (*Werk-Nr.* 4911) and **V2** (*Werk-Nr.* 4912), but at the end of 1936, some four months before the initial flight of the first of these prototype bombers, it was already obvious that the entire programme was destined to be cancelled, and Junkers requested permission of the RLM to utilize certain major components of the third prototype, the **Ju 89 V3** (*Werk-Nr.* 4913), for a proposed transport derivative.

Permission was duly granted at the beginning of 1937 with the proviso that, should the transport be ordered by Deutsche Lufthansa (DLH)





The Ju 90 V5, served as a Ju 290 development aircraft, and is seen here with the basic Ju 90 fuselage married to BMW 801MA engines and essentially similar wings to those of the Ju 290.

an alternative engine would be found for the Daimler-Benz DB 600 12-cylinder liquid-cooled power plant employed by the Ju 89 bomber. No objection was made to the retention of the DB 600 for the first prototype of the transport as the wing of the Ju 89 V3 was already complete and a change to other power plants demanded major reconstruction. Thus, the wings, engines, undercarriage and tail assembly of the Ju 89 V3 were mated to an entirely new transport fuselage to become the **Ju 90 V1** *Der Grosse Dessauer* (D-AALU).

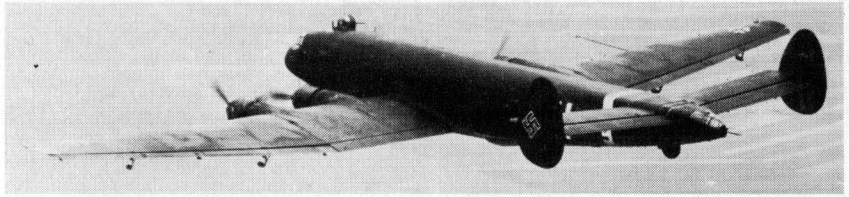
Dipl. Ing. Ernst Zindel, chief designer of the Ju 89, had initiated the first design studies for a commercial version of the bomber as a private venture in April 1936, DLH evincing only a vague interest in the project, but by the beginning of 1937, this interest had hardened, despite the fact that the only alternative engine to the DB 600 was the BMW 132 air-cooled radial with which the Ju 90 transport would obviously be somewhat under-powered. Thus, by the time the Ju 90 V1 made its initial flight on August 28, 1937, the redesign of the transport by one of Ernst Zindel's principal assistants, Dipl. Ing. Kraft, had already begun, the project being referred to as the **Ju 90S**, the suffix letter indicating *Schwer* (Heavy).

In the meantime, work had begun at Dessau on three additional prototypes and a batch of 10 **Ju 90B-1** 38–40 passenger transports powered by BMW 132H nine-cylinder radial air-cooled engines each rated at 880 h.p. for take-off and possessing a maximum continuous rating of 830 h.p. The **Ju 90 V2** *Preussen* (*Werk-Nr.* 4914 D-AIVI) and **V3** *Bayern* (*Werk-Nr.* 4915 D-AURE) were completed early in 1938, and during the following summer some attempt was made to gain favourable publicity for the new transport, two load-to-altitude records (11,023 lb. to 30,551 ft. and 22,046 lb. 23,760 ft.) receiving much acclaim during June, it being inferred that the records had been established by the Ju 90 V1. In fact, the Ju 90 V1 had broken up in flight while undergoing flutter tests on February 6, 1938, and the records had been established by the Ju 89 V1 bomber prototype. The Ju 90 V3 was demonstrated publicly at Tempelhof on July 19, 1938, and the Ju 90 V2 came to grief at Bathurst five months later while on loan to DLH for tropical trials. Nevertheless, DLH confirmed its order for eight Ju 90B-1 transports, and South African Airways took on the remaining two aircraft on the initial production batch which, with Pratt & Whitney SC3-G Twin Wasp engines, were to be designated as **Ju 90Z-2**s.

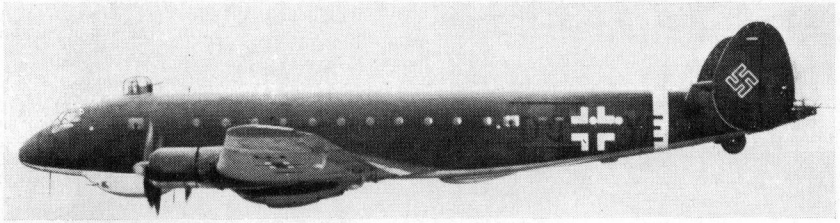
Production deliveries of the Ju 90B-1 to DLH began late in 1938, by which time the first services had already been operated over the Berlin-Vienna route with the Ju 90 V3. The B-series prototype was the **Ju 90 V4** (*Werk-Nr.* 4916 D-ADLH) *Sachsen*. The 10 production aircraft were allocated *Werk-Nummern* 90

0001 to 0010 inclusive but were *also* allocated *Versuchs* numbers, the first production Ju 90B-1 *Württemberg* (*Werk-Nr.* 90 0001 D-ABDG) being, for example, also the **Ju 90 V5**, while the two Ju 90Z-2s (*Werk-Nummern* 90 0004 and 0005) were also the **Ju 90 V8** and **V9** respectively. Incidentally, the two Ju 90Z-2s, which were to have been registered ZS-ANG and -ANH in SAA service, were completed in the summer of 1939 but destined never to be delivered to South Africa.

Throughout the latter half of 1937 and the early months of 1938, the redesign of the basic airframe as the Ju 90S had been continuing under Dipl. Ing. Kraft on the assumption that the new BMW 139 14-cylinder radial air-cooled engine would eventually be available for installation in the transport, and the **Ju 90 V5** (*Werk-Nr.* 0001 D-ABDG) *Württemberg* was allocated to the test programme. The Ju 90 V5 was rebuilt early in 1939 with an entirely new wing in which the marked leading-edge sweep-back gave place to a straight centre section with tapered outer panels. Simultaneously, enlarged and redesigned endplate vertical tail surfaces were applied to ensure adequate stability around the yawing axis with the larger, more powerful engines that it was proposed to eventually install, and sturdier twin-wheel main undercarriage members were provided to cater for the increased operating weights.

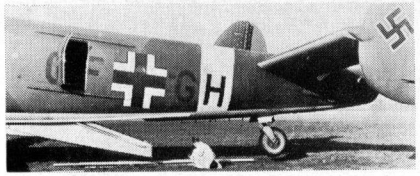


(*Above and below*) *The Ju 90 V8* (*Werk-Nr.* 90 0004) *was the first prototype for the Ju 290A to be fitted with defensive armament.*



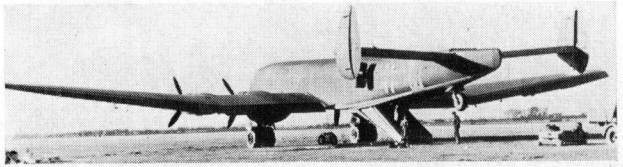
A further change was the introduction of the newly-developed *Trapoklappe*, an hydraulically-powered ventral loading ramp which, when fully lowered, raised the tail of the aircraft from the ground, providing a level freight deck and enabling vehicles to be driven beneath the fuselage so that they could be unloaded directly on to the ramp. Field vehicles up to the size of a *Kübelwagen* could be driven up the ramp which could also be lowered in flight for paradrops.

When, late in 1939, three design offices were available to Junkers in Prague, it was decided to transfer the entire Ju 90S design programme to Prague from Dessau, Dipl. Ing. Kraft being simultaneously appointed chief designer of the entire Ju 90S development, the former Letov factory at Letňany being responsible for design, mock-up construction and the static and dynamic testing of components, the Dessau plant retaining responsibility for prototype construction and assembly, and test flying, and Junkers' Bernburg plant being allocated the responsibility for future series production.

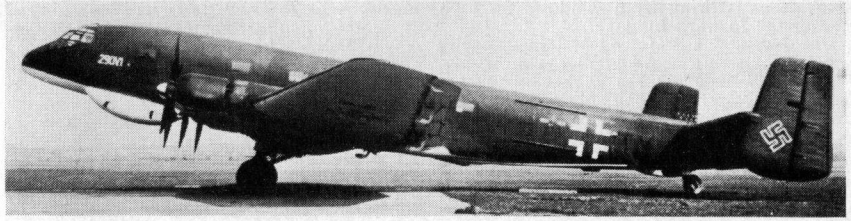


Shortly after hostilities commenced, the *Luftwaffe* took-over the few Ju 90B-1s that had been delivered to DLH, together with those awaiting delivery at Dessau, and only two of these were destined to be returned to the airline (D-AEDS *Preussen* and D-ADLH *Sachsen*), the remainder being retained by the *Luftwaffe* for transport tasks or returned to Dessau for modification and subsequent participation in the Ju 290 (as the Ju 90S had now been redesignated) development programme. During 1940, the Ju 90 V4 had been re-engined, the low-powered BMW 132H nine-cylinder radials giving place to the 14-cylinder BMW 801MA (the BMW 139 having earlier been abandoned in favour of this somewhat heavier but potentially more powerful engine), and these were retrospectively added to the V5 which was used at Letňany for trials with blown flaps. These trials proved unsuccessful, and at the suggestion of Professor Hertel, who had joined Junkers in May 1939 as Technical Director and Chief of Development, the ailerons and flaps were redesigned.

The **Ju 90 V7** (GF-GH and formerly Ju 90B-1 *Werk-Nr.* 90 0003 D-ADFJ *Baden*) embodied yet a further modification, an additional fuselage section some 6 ft. 6in. in length immediately aft of the rear spar attachment point, overall length being increased from 86 ft. 11¼ in. to 94 ft. 2 in. The lengthened aft fuselage eradicated a yawing problem, restoring the c.g. position



The Ju 90 V7 featured a 6 ft. 6 in. increase in fuselage length, and was fitted with the hydraulically-operated Trapoklappe.



The definitive prototype for the Ju 290A, the Ju 90 V11 (alias Ju 290 V1), which crashed on January 13, 1943 while taking-off from an airfield in the vicinity of Stalingrad.

which had shifted with the installation of the more powerful engines despite the aft movement of the inboard engines resulting from the provision of the straight wing centre section. By this time, the Ju 290 was envisaged as both a transport and a maritime reconnaissance aircraft, and the next prototype, the **Ju 90 V8** (formerly the first Ju 90Z-2 *Werk-Nr.* 90 0004 initially flown as D-AQJA) was completed with full defensive armament. The Ju 90 V8 (DJ-YE) embodied the lengthened fuselage of the V7 and introduced a small gondola beneath the port side of the fuselage nose and housing a forward-firing 20-mm. MG 151 cannon and an aft-firing 13-mm. MG 131 machine gun, a forward hydraulically-operated dorsal turret mounting a 20-mm. MG 151 cannon, a third 20-mm. MG 151 cannon in the extreme tail where a prone position was provided for the gunner, and provision for two MG 131 machine guns firing from lateral mountings in the fuselage sides.

Preparations for the series production of the Ju 290A had begun at Bernburg early in 1942, but still further changes were to be embodied in the wing before it was to reach its definitive form, and the **Ju 90 V11** alias **Ju 290 V1** (originally Ju 90B-1 *Werk-Nr.* 90 0007 D-AFHG *Oldenburg*) had wing span and area increased from 118 ft. 1⅓ in. to 137 ft. 9½ in. and 1,980.5 to 2,191.53 sq. ft. respectively. Further, the circular windows in the fuselage gave place to rectangular windows, and the oval endplate fins and rudders that had characterised all Ju 90s participating in the Ju 290 development programme were supplanted by more angular surfaces. Lacking defensive armament but retaining the offset gondola beneath the nose, the Ju 290 V1 (BD-TX) commenced flight testing in August 1942.

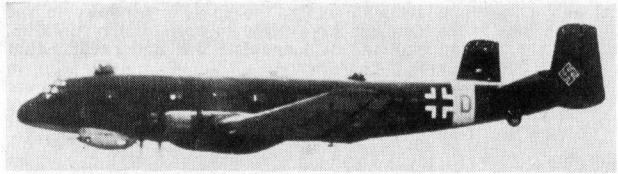
JUNKERS JU 290A

The first pre-production **Ju 290A-0** (*Werk-Nr.* 0150) was completed at Bernburg in October 1942 with BMW 801L engines each rated at 1,600 h.p. for take-off and 1,380 h.p. at 15,100 ft., this, like a second Ju 290A-0 and five **Ju 290A-1**s (*Werk-Nummern* 0152–0156) being completed as a transport and possessing essentially similar defensive armament to that of the Ju 90 V8, although this was later supplemented by forward maintenance units which introduced a pair of 7.9-mm. MG 15

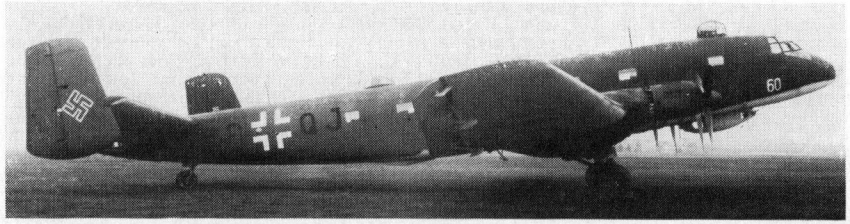
machine guns firing from windows on each side of the forward fuselage.

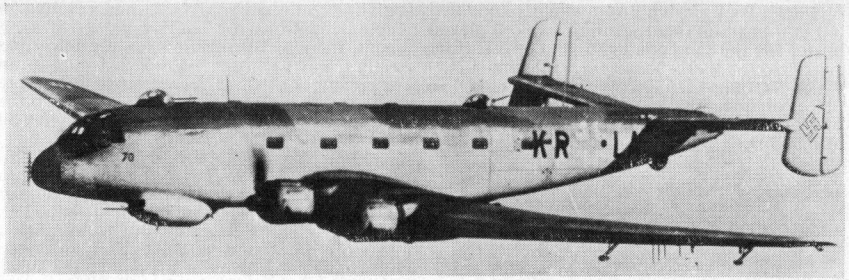
The *Luftwaffe*'s dire need of large-capacity transport aircraft necessitated the Ju 290As being taken over by the *Luftwaffe* straight from the assembly line, and one of the Ju 290A-0s together with the Ju 290 V1 were immediately allocated for supply missions to the beleaguered German 6th Army at Stalingrad, the first flight to and from an airfield in the vicinity of the Russian city being made on January 10, 1943. Three days later, the Ju 290 V1 crashed while taking-off with a load of wounded troops being evacuated to Germany and the Ju 290A-0 was attacked by LaGG-3 fighters during its final approach on its first flight from Germany, and was so badly damaged that it was unable to land and had to return to its base.

Meanwhile, on January 2nd, the so-called *Viermotorige Transportstaffel* had been formed at Tempelhof under the command of *Hauptmann* Braun, this unit being redesignated LTS 290 shortly after its establishment, indicating that its primary equipment was intended to be the Ju 290. However, at the time of its formation it possessed only two Ju 290As, four Ju 90Bs, the Ju 90 V4, V7 and V8, the Ju 252 V5 and one Fw 200B. LTS 290 was intended primarily for operations in the Balkans and Mediterranean, but was initially under the direct command of the *Lufttransport-Chef* in Berlin, undertaking long-range missions for the *Oberkommando der Luftwaffe* until March 1943 when it was transferred to Grosseto to operate under the *Luft-Transport-Führer Mittelmeer* to supply bases in Tunisia, Sardinia and Corsica. Both Ju 290As had been lost to enemy action by the end of April and no longer possessing any transports of



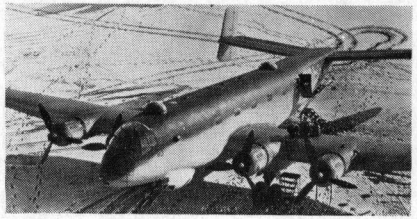
(Left and below) The Ju 290A-3 differed from the initial maritime patrol version in having a low-drag aft turret. Five Ju 290A-3s were followed by 11 Ju 290A-5s (see opposite page).





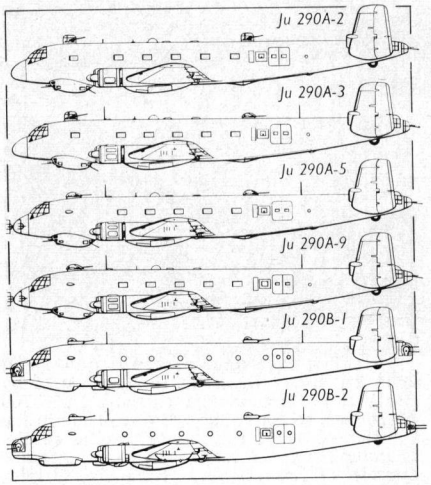
this type, priority having been given to the production of the Ju 290 for the maritime reconnaissance role, the LTS 290 was redesignated Trs.Fl.St.5 (*Transport-Fliegerstaffel* 5).

The decision to adapt the Ju 290 for the maritime role had resulted from a demand from the *Fliegerführer Atlantik* for an aircraft with adequate endurance to reconnoitre far out over the Atlantic, accurately plotting Allied convoys and assembling and marshalling U-boat packs for favourable interception. The Fw 200C Condor was proving too vulnerable in this role with the steady improvement in the defensive capabilities of Allied convoys, and the first maritime reconnaissance model of the Junkers aircraft, the **Ju 290A-2**, was a straightforward adaptation of the Ju 290A-1 transport apart from an increase in navigational equipment, the only concessions to its new role being the provision of a second HDL 151 dorsal turret mounting a 20-mm. MG 151 cannon, and large-capacity auxiliary tanks in the fuselage. Even the *Trapoklappe* was retained so that the aircraft could revert to the transport role as the military situation dictated.



The first maritime reconnaissance Ju 290A-2 (SB-QG *Werk-Nr.* 0157) powered by BMW 801L engines and carrying FuG 200 *Hohentwiel* search radar was completed in the summer of 1943, this aircraft going to the *Erprobungsstelle* Rechlin, and two similar aircraft (*Werk-Nummern* 0158 and 0159), being delivered to the *Fernaufklärungs-Gruppe* 5 (FAGr 5), a two-*Staffel* unit formed on July 1, 1943 specifically to operate the Ju 290. The three Ju 290A-2s were followed off the Bernburg assembly line by three **Ju 290A-3**s (*Werk-Nummern* 0160–0162) which differed solely in having a low-drag aft dorsal turret

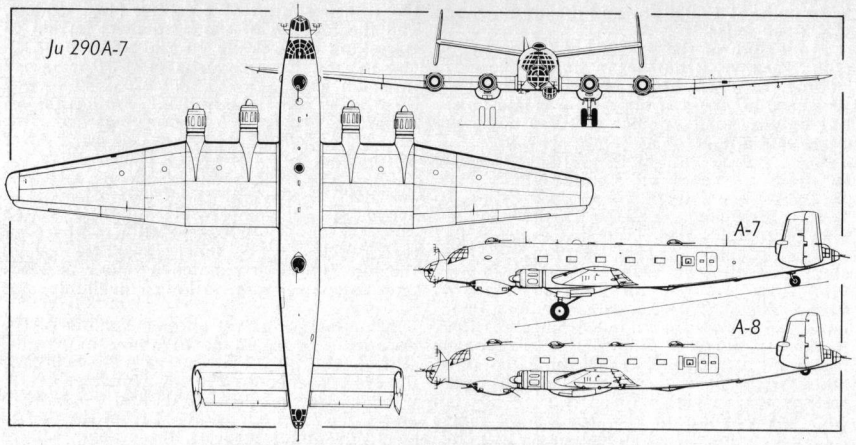
of Focke-Wulf design and a slightly modified tail gun position incorporating a raised glazed blister for the gunner's head, and two further Ju 290A-3s (*Werk-Nummern* 0163 and 0164) which standardised on the BMW 801D in place of the BMW 801L, the new engine offering 1,700 h.p. for take-off and 1,450 h.p. at 6,560 ft.



The five **Ju 290A-4**s (*Werk-Nummern* 0165–0169) that followed the similar quantity of Ju 290A-2s differed solely in having both fore and aft dorsal turrets of the flattened Focke-Wulf low-drag type, each mounting a 20-mm. MG 151 cannon, but by this time initial operations by FAGr 5 had resulted in recommendations for heavier defensive armament, increased protection for the pilot and co-pilot, and facilities for fuel dumping in an emergency, and these recommendations were embodied in the next variant to appear on the Bernburg assembly line late in 1943, the **Ju 290A-5**.

With a loaded weight of 90,323 lb. and powered by BMW 801D engines, the Ju 290A-5 introduced improved protection for the fuel tanks—earlier models had tended to ignite fairly easily when hit during combat—and both pilot and co-pilot were provided with heavy gauge armour aft and to the sides, this armour being capable of withstanding direct hits from 20-mm. shells. The aft lateral gun positions were aerodynamically improved, each mounting a 20-mm. MG 151 cannon in place of the 13-mm. MG 131 machine gun and embodying spoilers which deflected the airstream when the cannon was swung into firing position. At the same time the crew complement was increased from seven to nine.

A total of 11 Ju 290A-5 maritime reconnaissance aircraft (*Werk-Nummern* 0170 to 0180) were built, the next aircraft (*Werk-Nr.* 0181) being modified on the line as the prototype **Ju 290A-7** which began flight testing in the spring of 1944. A reconnaissance-bomber, the Ju 290A-7 differed externally from the A-5 in having an extended, bulbous glazed nose housing an additional 20-mm. MG 151 cannon, raising standard armament to no fewer than seven 20-mm. weapons and one 13-mm. weapon. Two ETC racks were mounted beneath the wings and a third beneath the fuselage, each of these being capable of lifting a 2,205-lb. bomb load, a Henschel Hs 293 or Hs 294, or FX 1400 *Fritz-X* missile. Maximum loaded weight was increased to 101,413 lb., maximum speed was



JUNKERS JU 290A-5 SPECIFICATION
(Figures in parentheses relate to the Ju 290A-7)

Type: *Long-range Maritime Reconnaissance (-Bomber).* **Power Plants:** *Four BMW 801D 14-cylinder radial air-cooled engines each rated at 1,700 h.p. for take-off, 1,450 h.p. at 6,560 ft., and 1,310 h.p. at 19,030 ft.* **Armament:** *One 20-mm. MG 151 cannon in each of two hydraulically-operated dorsal turrets, two 20-mm. MG 151 cannon firing from aft lateral positions, one 20-mm. MG 151 cannon in extreme tail, one 20-mm. MG 151 cannon in nose of offset ventral gondola and one 13-mm. MG 131 machine gun in tail of offset ventral gondola (plus one 20-mm. MG 151 cannon in glazed nose and 6,615-lb. bomb load or up to three Henschel Hs 293, Hs 294 or FX 1400 Fritz-X missiles).* **Performance:** *Maximum speed, 273 (272) m.p.h. at 19,030 ft. (with two Hs 293 missiles, 255 m.p.h.); normal cruising speed at 88,190 (90,105) lb., 224 (219) m.p.h.; range at max. economical cruising speed with 4,620 Imp. gal. fuel, 3,820 (3,785) mls. (with 4,180 Imp. gal. plus two Hs 293 missiles, 3,260 mls.); climb to 6,090 ft. at 90,323 (99,208) lb., 9.8 (11.3) min.; service ceiling, 19,685 ft.* **Weights:** *Normal loaded, 90,323 (99,208) lb.; maximum overload, 99,140 (101,413) lb.* **Dimensions:** *Span, 137 ft. 9½ in.; length, 93 ft. 11½ in. (95 ft. 7¾ in.); height, 22 ft. 4¾ in.; wing area, 2,191.53 sq. ft.*

272 m.p.h. at 19,030 ft., and maximum range was 3,600 miles.

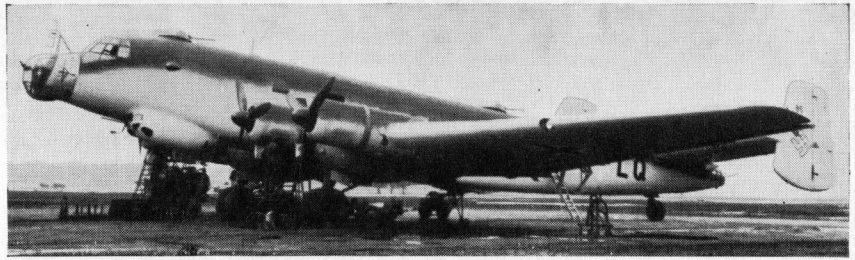
Production of the Ju 290A-7 (commencing with *Werk-Nr.* 0186) began during the early summer of 1944, and a series of 25 reconnaissance-bombers of this type was laid down, but only a small number of these had been completed when the Bernburg assembly line came to a standstill, and the Ju 290A-7 failed to attain service status. One example of the Ju 290A-7 was later flown by its crew to the U.S.A. for evaluation.

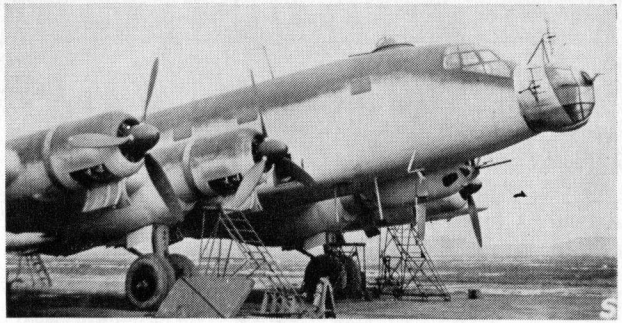
Prior to the commencement of Ju 290A-7 series production, the Bernburg factory completed three **Ju 290A-9**s (*Werk-Nummern* 0182-0184) and one **Ju 290A-6** (*Werk-Nr.* 0185). The Ju 290A-9 was a maritime reconnaissance aircraft for extended-range missions, featuring increased internal fuel tankage providing a maximum range of 5,160 miles and substantially reduced armament, this being restricted to a single forward-firing 20-mm. MG 151 cannon in the gondola, a single forward-mounted hydraulically-operated dorsal turret mounting a similar weapon, and a third MG 151 in the extreme tail. Maximum loaded weight was 99,030 lb., and maximum speed was 282 m.p.h. The sole Ju 290A-6 was initially conceived as a pressurized personnel transport for Hitler's personal flight. Some pressurization trials were conducted at Prague but this scheme was abandoned at an early stage, and the aircraft was completed as an unpressurized 50-passenger transport. This aircraft was eventually taken on the strength of I/KG 200 at Finsterwalde for special transport operations and, in the last week of April 1945, flown to Barcelona by *Hauptmann* Braun, the original *Staffelkapitän* of LTS 290 who subsequently served with FAGr 5 and, with the disbandment of that *Gruppe*, joined *Kampfgeschwader* 200.

The I/KG 200 was largely responsible for the transportation of escaping Nazi leaders, and the identity of the passengers ferried to Barcelona aboard the Ju 290A-6 is open to conjecture. However, the aircraft remained in Spain, eventually being purchased by the Spanish government in May 1950 from an Allied Commission responsible for the disposal of former enemy assets. After overhaul at León and the replacement of the decayed Buna fuel tanks by metal tanks, the Ju 290A-6 served with the *Escuela Superior de Vuelo* at Salamanca/Matacán, being used during exercises in co-operation with naval forces and as a personnel transport until, in the mid 'fifties, it suffered a minor accident and, as spares were no longer available, was scrapped.

Manufacture of yet another version of the A-series was begun at Bernburg in parallel with the Ju 290A-7 late in 1944, this being the **Ju 290A-8**. The Ju 290A-8, which possessed a loaded weight of 99,210 lb. and a maximum speed of 271 m.p.h., differed from the A-7 in relatively minor respects, these comprising a reduction in fuel capacity, the introduction of two additional hydraulically-operated dorsal turrets, and the provision of a new tail gun position. This new position housed the gunner in a seated position for the first time, was armoured and mounted a pair of vertically disposed 20-mm. MG 151 cannon. Total defensive armament of the Ju 290A-8 thus comprised four hydraulically-operated turrets each mounting a single MG 151 cannon, single forward-firing MG 151 cannon in the glazed nose and the nose of the offset gondola, two MG 151s in lateral positions, an aft-firing MG 131 in the tail of the gondola and a pair of MG 151s in the extreme tail.

A pre-production series of 10 Ju 290A-8s (*Werk-Nummern* 0211-0220) was laid down at Bernburg, and the production model was intended to commence with *Werk-Nr.* 0221,





(*Above and right*) *The first production Ju 290A-7 which differed externally from the Ju 290 A-5 primarily in having an extended, bulbous glazed nose.*

but only two or three of the pre-production machines were completed, and after the liberation of Ruzýně airfield, near Prague, the second pre-production Ju 290A-8 (*Werk-Nr.* 0212) was discovered partly disassembled, together with major assemblies for a Ju 290B-2. The components were transported to the Letov factory, suitable engines and instruments were unearthed in former *Luftwaffe* depots, and assembly and modification of the Ju 290A-8 as a transport was begun. As no Ju 290 airscrews were found with the engines it was decided to employ airscrews intended for Fw 190A fighters which, although of smaller diameter, were considered suitable. With the offset gondola and all armament removed, and the nose and tail gun positions faired over, the aircraft was flown in August 1946 as the L 290 Orel. The aircraft was offered to Czechoslovak Airlines as a 48-passenger transport, but little interest was evinced in the aircraft which was left to

JUNKERS JU 290B-2 SPECIFICATION

(Performance Data is based on Manufacturer's Estimates)

Type: *Long-range Heavy Bomber.* **Power Plants:** *Four BMW* 801*E* 14-*cylinder radial air-cooled engines each rated at* 1,970 *h.p. for take-off,* 1,740 *h.p. at* 6,560 *ft., and* 1,460 *h.p. at* 20,340 *ft.* **Armament:** (*Defensive*) *Four* 13-*mm. MG* 131 *machine guns with* 1,300 *r.p.g. in nose turret, two* 20-*mm. MG* 151 *cannon with* 1,200 *r.p.g. in both forward and aft dorsal turrets, twin* 20-*mm. MG* 151 *cannon with* 800 *r.p.g. in remotely-controlled ventral barbette, two* 20-*mm. MG* 151 *cannon firing from aft lateral positions, and two* 20-*mm. MG* 151 *cannon in extreme tail.* (*Offensive*) *Two ETC beneath wings for bombs up to* 2,205 *lb. in weight or two Hs* 293, *Hs* 294 *or FX* 1400 *Fritz-X missiles.* **Performance:** *Maximum speed,* 276 *m.p.h. at* 18,045 *ft.; range with two Hs* 293 *missiles and* 4,000 *Imp. gal. fuel,* 3,480 *mls.; maximum range,* 4,970 *mls.; service ceiling,* 24,600 *ft.* **Weights:** *Maximum loaded,* 111,330 *lb.* **Dimensions:** *Span,* 137 *ft.* 9½ *in.; length,* 96 *ft.* 1½ *in.; height,* 22 *ft.* 4¾ *in.; wing area,* 2,191.53 *sq. ft.*

languish at Letňany, near Prague, and although an Israeli buyer presented himself in 1947, various complications prevented the sale of the machine which was finally scrapped in 1956.

JUNKERS JU 290B

Late in 1943, work began on the prototype of a further development of the basic design, the **Ju 290B-1** which, dispensing with the *Trapoklappe* for the first time, was intended specifically for the role of long-range high-altitude heavy bomber. Intended to carry all offensive loads externally, the Ju 290B-1 embodied considerable structural strengthening and featured pressurized, Borsig-designed nose and tail turrets each mounting four 13-mm. MG 131 machine guns, two pressurized dorsal turrets each with two 20-mm. MG 151 cannon, and a remotely-controlled ventral barbette also with twin MG 151s, a shallow sighting station for this barbette taking the place of the offset gondola of A-series aircraft. The flight deck was intended to be pressurized, tests with the pressure cabin being conducted at Prague, a crew of eight was carried and proposed offensive armament was similar to that of the Ju 290A-7. The prototype Ju 290B-1 was flown in the summer of 1944 without pressurization equipment and with wooden nose and tail turret mock-ups, eventually being flown to Prague (where it was still flying in March 1945) as a development aircraft for later Ju 290 series aircraft.

Before the prototype of the Ju 290B-1 was completed, production plans for this model had been abandoned in favour of the **Ju 290B-2** which dispensed with the turret and flight deck pressurization, reintroduced MG 151 beam guns, and replaced the MG 131V tail turret with a tail position similar to that of the Ju 290A-8 and mounting twin MG 151s. Although production of a pre-series of Ju 290B-2 bombers was commenced at Bernburg, the general situation had deteriorated so much by the autumn of 1944 and supplies of strategic materials had become so critical that all production of the Ju 290 was stopped.

This decision resulted in the abandoning of several other variants of the basic design, including the **Ju 290B MS** with mine degausing ring and defensive armament restricted to the tail gun position, the **Ju 290C** long-range reconnaissance aircraft and transport, and the **Ju 290D** and **E** bombers. The Ju 290C was, like the Ju 290B-2, to have been powered by BMW 801E engines but was to have featured a redesigned loading ramp which could incorporate a mounting for twin MG 151 cannon. The Ju 290D was to have been essentially similar to the Ju 290C apart from having a fuselage fuel tank removed to provide space for Hs 293 missile control equipment, and the Ju 290E was to have employed considerable structural redesign to permit the insertion of internal bomb-bays capable of accommodating four 5,512-lb. bombs or up to 40 551-lb. bombs. It was proposed that the initial model of the Ju 290E would be powered by BMW 801E engines but that the definitive production model would supplant these with Jumo 222A-3/B-3 power plants with which maximum gross weight would have been no less than 133,380 lb.

OPERATIONAL CAREER

The 1.*Staffel* of *Fernaufklärungs-Gruppe* 5 with Ju 290A-2s and -3s joined operations over the Atlantic on October 15, 1943, the unit being based at Mont de Marsan, South of Bordeaux, where it was joined a month later by 2.*Staffel*, the operational area extending from Gibraltar, past the North-West coast of Africa, thence westward past the Azores to 30° W, and up this longitude to approximately 55° N, and thence back to the West coast of Ireland but including the North Channel and the Hebrides. The FuG 200 *Hohentwiel* search radar fitted to FAGr 5's Ju 290As was used to locate convoys at a range of 50 miles from an altitude of 1,640 ft. or 62 miles from 3,280 ft., and the aircraft would continuously send out the convoy's bearings to U-boats for several hours until relieved by another aircraft from Mont de Marsan.

The Ju 290A possessed excellent handling characteristics and enjoyed the confidence of its crews, and FAGr 5 suffered no accidental losses, its only casualties being due to enemy action. The *Gruppe* was intended to possess an establishment of three *Staffeln* with a total strength of 40 aircraft, but strength never reached more than about 20 aircraft, and hopes of increasing the unit to full *Geschwader* strength proved illusory. Rarely were sufficient aircraft available to meet all the demands placed on FAGr 5 which, from time to time, included reconnaissance missions for *Kampfgeschwader* 40.

In the early spring of 1944, the first examples of the improved Ju 290A-5 began to supplement the Ju 290A-2s, -3s and -4s in FAGr 5 service, and another *Staffel*, 4./FAGr 5, was formed, but total strength remained barely a score of aircraft which was totally inadequate for the task allocated to the *Gruppe*, and this strength was further depleted when, shortly after the formation of 4./FAGr 5 three aircraft were recalled to Germany where, within 48 hours at Finsterwalde, they had been completely stripped of armour and armament, fitted with two additional 550 Imp. gal. fuel tanks to increase the total fuel load to 5,235 Imp. gal. From Odessa and Mielec, the aircraft were flown non-stop to Manchuria with special cargoes, refuelling and returning to Mielec with strategic materials that were in critical supply in Germany.

The *Fernaufklärungs-Gruppe* 5 was pulled out of France in August 1944, the surviving Ju 290As being mostly relegated to transport tasks, several being transferred to I/KG 200, serving primarily with 3.*Staffel* on agent-dropping and other special operations, a drop hatch being introduced in the fuselage.

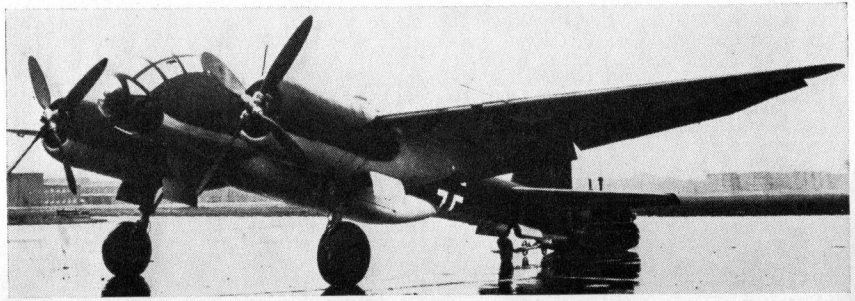
With the failure of the "Bomber B" programme and the fast approaching obsolescence of much of the *Luftwaffe*'s bomber, reconnaissance and *Zerstörer* equipment, the provision in the minimum possible time of warplanes possessing very much higher operational ceilings and speeds assumed the utmost urgency. The Ju 388 offered both this desired performance increment and the possibility of achieving it quickly without serious disruption of existing production arrangements. Thus, the importance attached by the RLM to the *Hubertus* programme, as Ju 388 development had been dubbed, can be imagined.

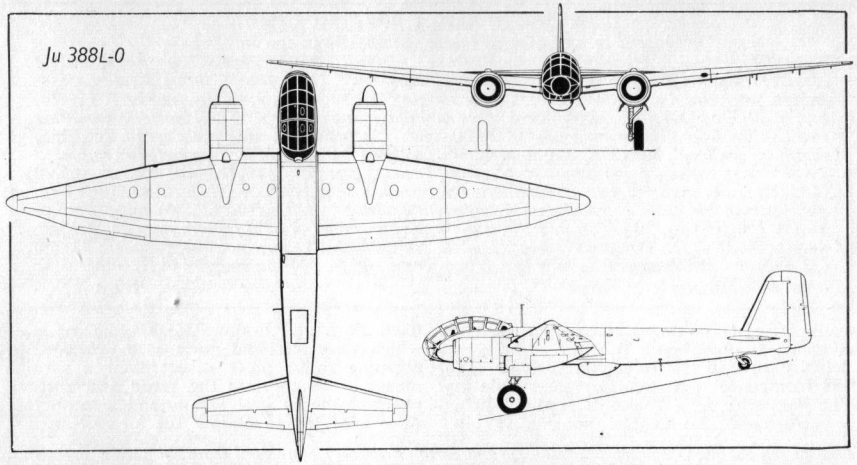
With the début of the Ju 388, almost the last vestiges of the external appearance of the original Ju 88 had disappeared, yet the basic structure, progressively strengthened and modified though it may have been during its production life, remained essentially unchanged. Initiated in September 1943, the *Hubertus* programme called for the development of three basic variants of the Ju 388—the Ju 388J *Störtebeker* high-altitude bad weather fighter, the Ju 388K high-altitude bomber, and the Ju 388L high-altitude photographic-reconnaissance aircraft.

Originally proposed to the *Technische Amt* of the RLM as parallel developments of the Ju 188S and T, and, in fact, known in their original project form as the Ju 188J, K and L respectively, the Ju 388s shared a common airframe with the Ju 188, and, in the case of the Ju 388K and L, an identical pressurized forward fuselage to that employed by the Ju 188S and T.

Prototypes of all three basic models of the Ju 388 were ordered, these utilizing for the most part standard Ju 188 components, priority being given to the reconnaissance model, and whereas the original project

The Ju 388 V3, the prototype for the Ju 388K high-altitude bomber. The Ju 388 V3 was not fitted with the FA 15 defensive tail barbette.





studies had envisaged the use of Jumo 213E-1 engines, the uncertainty of adequate supplies of this power plant resulted in a decision to standardize on the turbo-supercharged BMW 801TJ for the initial series of all three versions, supplanting the air-cooled radial with the Jumo as and when the supply situation improved.

JUNKERS JU 388L

The first example of the Ju 388 was the prototype for the long-range reconnaissance version that, designated **Ju 388L V1** and completed late in 1943, was rebuilt at Dessau from a Ju 188T-1 airframe. Successful trials at the *Erprobungsstelle* Rechlin resulted in instructions being issued to the Allgemeine Transportanlagen GmbH (ATG) at Merseburg, near Leipzig, for the conversion of 10 Ju 88S-1 airframes as pre-production **Ju 388L-0** reconnaissance aircraft. The first of these conversions was accepted by the *Luftwaffe* in August 1944, by which time preparations for the series production of the **Ju 388L-1** at Merseburg were virtually complete.

It had been planned from the outset that all versions of the Ju 388 should feature the MG 131Z/FA 15 remotely-controlled tail barbette, which, mounting a vertically-disposed pair of 13-mm. machine guns, was being tested by the Ju 188C-0, but teething troubles had delayed *Luftwaffe* acceptance of the barbette. The barbette was intended to provide the sole defensive armament of the Ju 388L, but its non-availability for installation in the pre-production Ju 388L-0 necessitated the 10

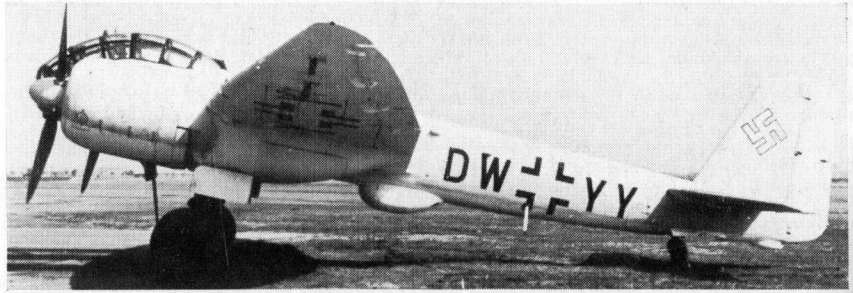
JUNKERS JU 388L-1 SPECIFICATION

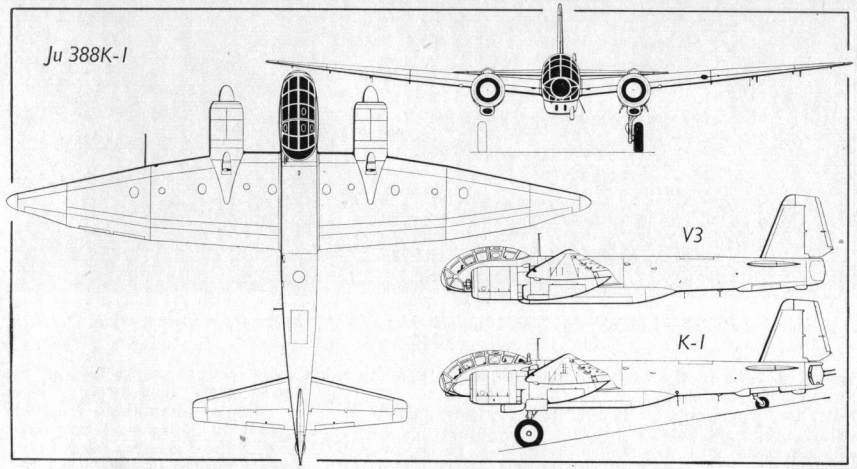
(Figures in parentheses relate specifically to the Ju 388L-3)

Type: *Three-seat Photographic-Reconnaissance Aircraft.* **Power Plants:** *Two BMW* 801*TJ* (*Junkers Jumo* 213*E*-1) 14-*cylinder radial air-cooled* (12-*cylinder inline liquid-cooled*) *engines each rated at* 1,800 (1,750) *h.p. for take-off*, 1,890 *h.p. at* 9,850 *ft., and* 1,410 (1,320) *h.p. at* 40,300 (35,400) *ft.* **Armament:** *One remotely-controlled FA* 15 *tail barbette mounting two* 13-*mm. MG* 131 *machine guns with* 600 *r.p.g.* **Performance:** *Maximum speed*, 258 (285) *m.p.h. at sea level*, 383 (376) *m.p.h. at* 40,300 (33,500) *ft.*, (*with MW* 50 *boost*, 407 *m.p.h. at* 29,800 *ft.*); *range at maximum continuous cruising speed*, 1,414 (1,600) *mls. at* 36,000 (30,200) *ft., at maximum economical cruising speed*, 1,838 (1,900) *mls., with* 198 (186) *Imp. gal. jettisonable tank at maximum economical cruising speed*, 2,160 (2,285) *mls.; time to* 36,100 (30,200) *ft.*, 30 (27.5) *min.; initial climb rate*, 1,330 (1,625) *ft./min.; service ceiling*, 44,100 (40,000) *ft.* **Weights:** *Normal loaded*, 30,450 (30,820) *lb.; maximum loaded*, 32,350 (32,350) *lb.* **Dimensions:** *Span*, 72 *ft.* 2 *in.; length*, 49 *ft.* 10½ *in.; height*, 14 *ft.* 3 *in.; wing area*, 602.778 *sq. ft.*

examples of this version being fitted with the so-called *Waffentropfen* WT 81Z prior to the delivery to the *Erprobungskommando d.Lw* 388 formed to undertake service evaluation. The *Waffentropfen* (Weapon Drop) comprised a teardrop-shaped ventral housing for two fixed aft-firing 7.9-mm. MG 81 machine guns which were intended more as a deterrent to persuing interceptors rather than a serious means of defence, as the speed and altitude at which the Ju 388L was intended to operate were expected to endow the aircraft with a

One of ten Ju 388*L*-0 *pre-production reconnaissance aircraft converted from Ju* 88*S*-1 *airframes. Note three-blade airscrews and Waffentropfen WT* 81*Z.*



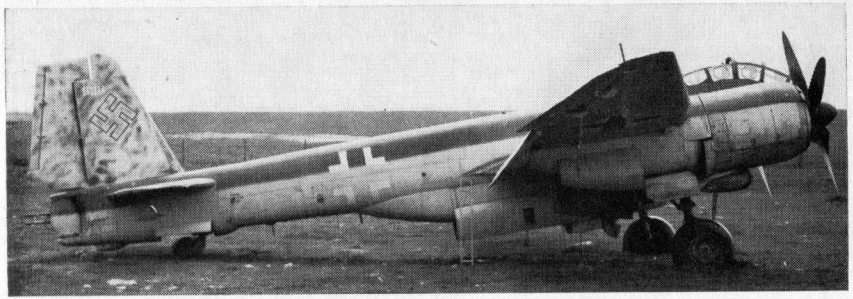


measure of immunity from interception.

The production Ju 388L-1 differed from the pre-production L-0 in several respects. The wooden three-blade airscrews were replaced by VDM-Dural four-bladers, FuG 217 *Neptun* tail-warning radar was introduced, and the large wooden ventral pannier featured by the parallel Ju 388K bomber was adopted to accommodate both cameras and a jettisonable auxiliary fuel tank.

Production deliveries of the Ju 388L-1 commenced in October 1944 from Merseburg, and in the following month deliveries also began from the "Weser" Flugzeugbau GmbH (WFG) at Bremen. Although most of the teething troubles suffered by the FA 15 tail barbette had been eliminated by the time deliveries of the Ju 388L-1 began, service trials revealed that at high speeds the angle adopted by the guns did not necessarily correspond with that desired by the gunner peering through the PVE 11 periscopic sights. Consequently, forward maintenance units decided to supplement the twin barbette guns with a third 13-mm. MG 131 firing aft above the fuselage from the starboard rear of the cockpit glazing, a fourth member being added to the crew complement. With this modification the aircraft was designated Ju 388L-1/b.

The BMW 801TJ engines were each rated at 1,800 h.p. for take-off and had a combat rating of 1,410 h.p. at 40,300 ft. Fuel was housed in two tanks in the wing centre section with a total capacity of 183 Imp. gal., a 93



A production Ju 388*L*-1 (*Werk-Nr.* 560044), *deliveries of which began from Merseburg in October* 1944.

Imp. gal. tank in the port outer wing panel, and a 110 Imp. gal. tank in the starboard outer wing panel, the last-mentioned tank being used only for climb to operational altitude and not being self-sealing. The fuselage housed one 370 and one 110 Imp. gal. tank, but for nocturnal reconnaissance missions internal capacity was reduced by 210 Imp. gal. A 198 Imp. gal. jettisonable tank could be carried in the ventral pannier which also housed two Rb 20/30, 50/30 or 75/30 cameras which, for night missions, gave place to two NRb 35/25, 40/25 or 50/25 cameras.

The **Ju 388L-3** differed from the Ju 388L-1 in having Jumo 213E-1 engines with MW 50 (methanol-water) injection and driving wooden VS 19 four-blade airscrews. A total of 37 Ju 388L reconnaissance aircraft had been delivered from the Merseburg factory by the end of 1944, including one or two examples of the Ju 388L-3, and "Weser" produced five Ju 388L-1s in November 1944, and a further five in December when, owing to the reduced priority enjoyed by reconnaissance aircraft as a result of the rapidly deteriorating war situation, both plants abandoned further production. Several Ju 388Ls had been delivered to 3.*Staffel* of the *Versuchsverband Ob. d.L.* late in 1944, but none of the *Fernaufklärungs-Staffeln* designated to receive this type completed conversion in time to become fully operational.

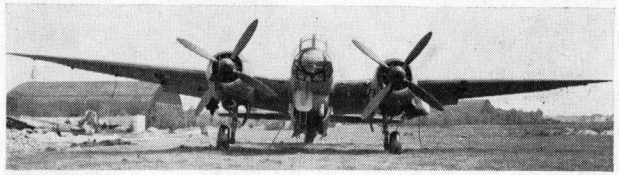
JUNKERS JU 388K

The **Ju 388 V3**, the prototype for the Ju 388K high-altitude bomber, followed the Ju 388L V1 in January 1944, and was fitted with the wooden ventral bomb pannier from the outset, this enabling a maximum bomb load of 6,610 lb. to be carried for shorter range missions, although a more normal load consisted of a single 4,409-lb. bomb or a pair of 2,205-lb. bombs. For defence the Ju 388K was intended to rely entirely on the FA 15 tail barbette coupled with its high performance, although the barbette was not available for installation in the Ju 388 V3 or the 10 pre-production **Ju 388K-0** bombers which began to leave Dessau in July 1944.

Like the Ju 388L-1, the Ju 388K-0 was powered by the BMW 801TJ, and it was intended to replace this engine by the BMW 801TM in the production Ju 388K-1, this having a modified low supercharger gear and ratings of 1,880 h.p. for take-off and 1,820 h.p. at 33,400 ft. However, in the event, the five **Ju 388K-1** bombers completed retained the BMW 801TJ, although the FA 15 barbette was fitted. Plans existed for two further versions of the bomber, the **Ju 388K-2** with Jumo 213E-1 engines and the **Ju 388K-3** with Jumo 222E/F engines, but neither variant had been flight tested when all further production terminated early in 1945. Yet another variant was the **Ju 388M-1** which, with a crew of four and lacking the ventral pannier, was intended as a carrier for winged torpedoes. Pre-production examples of the Ju 388M were under construction when the entire programme was cancelled.

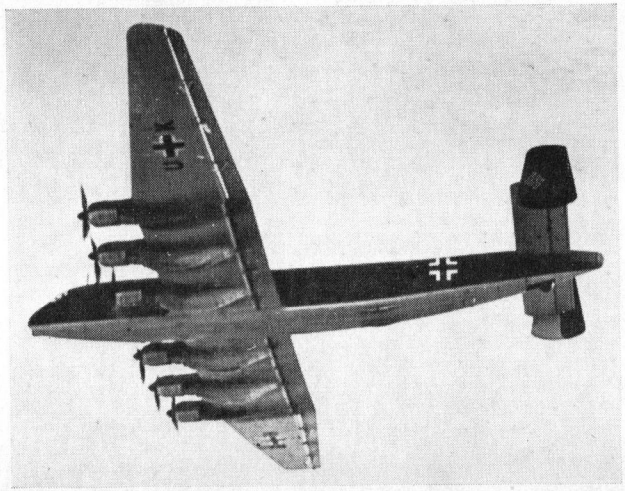
With the Ju 388, the basic Ju 88 design of 1936 had been carried to its ultimate development, and there can be little doubt that, had the *Luftwaffe* succeeded in bringing to operational service in quantity this final derivative of Junkers' *Schnellbomber*, the remarkable performance that it offered despite its size would have posed the Allies serious problems. As it was, apart from a few sorties by the reconnaissance model, the Ju 388 failed to see combat.

(*Right*) *A production Ju* 388*L*-1, *and* (*below*) *one of the few Ju* 388*K*-1 *bombers completed.*

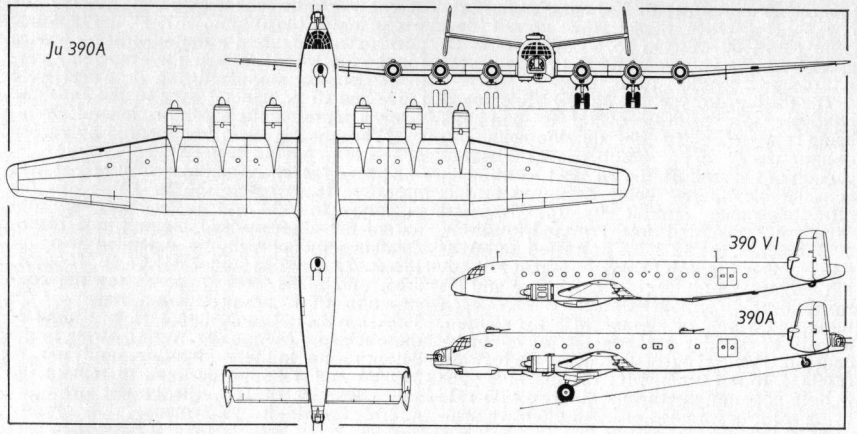


At an early stage in the production of the Ju 290A, Dipl. Ing. Kraft began to think in terms of scaling up the basic design by the simple expedient of adding fuselage bays, wing sections and engines, and early in 1942, the Junkers design office in Prague initiated a project study of a version of the Ju 290 with six BMW 801 engines and an enlarged wing spanning 154 ft. 2⅛ in. and possessing a gross area of 2,303.47 sq. ft. Conceived as a transport, maritime reconnaissance aircraft or long-range bomber, the essential simplicity of the project appealed to the *Technische Amt* of the RLM when, during the spring of 1942 it was submitted in competition with the Messerschmitt Me 264 and the Focke-Wulf Ta 400 to meet a requirement for an ultra-long-range bomber capable of attacking New York from European bases.

Allocated the designation Ju 390, three prototypes of the enlarged Ju 290 were ordered by the RLM of which the first was to be completed as a transport, the second as a maritime reconnaissance aircraft, and the third as a heavy bomber. Work began immediately on the **Ju 390 V1** at Dessau and the **Ju 390 V2** at Bernburg, extensive use being made of Ju 290A components. Flown in August 1943, the Ju 390 V1 (GH-UK) introduced an 8.07-ft. section in the fuselage immediately aft of the wing, increasing overall length from the 93 ft. 11½ in. of the Ju 290A



The Ju 390 *V*1, *first flown in August* 1943, *was used for a series of flight refuelling trials in* 1944 *when consideration was given to its use as a tanker for Ju* 290 *maritime patrol aircraft.*



to 102 ft. 0½ in., the wing centre section was extended to increase overall wing span to 165 ft. 0½ in., and power was provided by six BMW 801D engines each rated at 1,700 h.p. for take-off. The main landing gear was duplicated, with four twin-wheel units retracting into the inner engine nacelles, the outboard units only being extended at high gross weights. As a freighter, the Ju 390 V1 could carry 22,046-lb. load and 7,500 Imp. gal. of fuel for a range of 4,970 miles at 205 m.p.h. at 6,500 ft. It was also proposed to use the aircraft as a flight refuelling tanker for the Ju 290A, and successful trials were conducted with the aircraft at Prague-Ruzýně during 1944.

The Ju 390 V2 (RC-DA) began its flight test programme in October 1943, and apart from being equipped for the maritime role, this aircraft differed from its predecessor in having an 8.2-ft. section inserted in the forward fuselage, increasing overall length to 110 ft. 2¾ in. Equipped with FuG 200 *Hohentwiel* radar, and similar defensive armament to that of the Ju 290A-4, comprising fore and aft hydraulically-operated dorsal turrets each mounting a single 20-mm. MG 151 cannon, MG 151 cannon were mounted in the nose of the offset ventral gondola and in the extreme tail, and a pair of 13-mm. MG 131 machine guns were fired from beam hatches, a third MG 131 firing aft from the tail of the gondola. In January 1944, the Ju 390 V2 was delivered to *Fernaufklärungs-Gruppe* 5 at Mont de Marsan, south of Bordeaux, for operational evaluation. The Ju 390 V2 carried sufficient

fuel for an endurance of 32 hours, and after a few short-distance flights, the aircraft flew from Mont de Marsan to a point some 12 miles from the U.S. coast north of New York, returning successfully to its base.

The third prototype, the **Ju 390 V3**, enjoyed relatively low priority owing to emphasis being placed on Ju 290 development, but design work on a bomber-reconnaissance version of the aircraft, the **Ju 390A**, continued, considerable interest being displayed in this ultra-long-range aircraft by the Imperial Japanese Army Air Force. Powered by BMW 801E engines, the Ju 390A possessed an essentially similar fuselage to that of the Ju 390 V2, but defensive armament included fore and aft hydraulically-operated dorsal turrets each mounting a pair of 20-mm. MG 151 cannon, a pair of similar weapons in a remotely-controlled ventral barbette beneath the forward fuselage, four 13-mm. MG 131 machine guns in both nose and tail turrets, and two MG 151s firing from beam positions. All offensive armament was to be carried externally beneath the wings, and in the autumn of 1944, the Japanese government acquired a manufacturing licence for the **Ju 390A-1**. Under the licencing agreement detailed manufacturing drawings were scheduled to be handed over to the Japanese Army's representative, Major-General Otani, by February 28, 1945, but there is no record of this term having been fulfilled.

During the early summer of 1944, it was proposed to complete the Ju 390 V3 as the prototype Ju 390A. A project study was submitted for a pressurized high-altitude reconnaissance model with an extended wing of 181 ft. 7½ in. span and 2,841.67 sq. ft. gross area, and plans were prepared for the construction of a pre-production batch of Ju 390A-1 reconnaissance-bombers, but none of these schemes were to see fruition owing to the deteriorating military situation, and the Ju 390 V1 and V2 were destined to remain the sole examples of this, the largest orthodox aircraft ever built in Germany.

JUNKERS JU 390A-1 SPECIFICATION
(Data based on Manufacturer's Estimates)

Type: *Long-range Heavy Bomber and Reconnaissance Aircraft.* **Power Plants:** *Six BMW 801E 14-cylinder radial air-cooled engines each rated at* 1,970 *h.p. for take-off,* 1,740 *h.p. at* 6,560 *ft., and* 1,460 *h.p. at* 20,340 *ft.* **Armament:** (*Defensive*) *Four* 13-*mm. MG* 131 *machine guns with* 1,300 *r.p.g. in each of nose and tail turrets, two* 20-*mm. MG* 151 *cannon with* 1,200 *r.p.g. in each of fore and aft hydraulically-operated dorsal turrets, two* 20-*mm. MG* 151 *cannon with* 800 *r.p.g. in remotely-controlled ventral barbette, and two* 20-*mm. MG* 151 *cannon firing from aft lateral positions.* (*Offensive*) *Four carriers beneath wings each capable of lifting* 3,968 *lb. bombs or one Henschel Hs* 293, *Hs* 294 *or FX* 1400 *Fritz-X missile.* **Performance:** *Maximum speed without external load,* 314 *m.p.h. at* 20,340 *ft.; maximum long-range cruising speed,* 222 *m.p.h. at* 8,200 *ft.; maximum range* (*reconnaissance*), 6,030 *mls.,* (*bomber with* 4,255-*lb. bomb load*), 5,750 *mls.* **Weights:** *Empty equipped,* 81,350 *lb.; maximum loaded,* 166,450 *lb.* **Dimensions:** *Span,* 165 *ft.* 1 *in.; length,* 112 *ft.* 2½ *in.; height,* 22 *ft.* 7 *in.; wing area,* 2,729.73 *sq. ft.*

From an early stage in the war, the Luftwaffe had been embarrassed by its lack of heavy strategic bombers. It had been anticipated that this gap in the service's inventory would be filled by the Heinkel He 177, but the protracted development of this warplane coupled with the failure to eradicate its many serious shortcomings led, early in 1944, to the Junkers design bureau at Dessau proposing to the *Technische Amt* a relatively simple means of developing a strategic bomber with the minimum of disturbance to existing design and production arrangements. Junkers suggested producing a heavy four-engined bomber by adapting components of the Ju 188, Ju 288 and Ju 388, and the *Technische Amt* accepted this unorthodox proposal with alacrity, designating this mélange the Ju 488.

In detail, it was suggested that the complete pressurized forward fuselage and wings of the Ju 388K, the centre and aft fuselage of the Ju 188E, the wooden ventral pannier of the Ju 88A-15 and Ju 388K, and the tail assembly of the Ju 288C should be married by means of a new wing centre section carrying an additional pair of engines, and suitable additional fuselage sections. In order to reduce the work load at Dessau, the former Latécoère factory at Toulouse was allocated responsibility for production of the complete fuselages and new wing centre sections, the Bernburg factory of Junkers producing the outer wing panels, and the Dessau plant manufacturing the tail assemblies.

Work began immediately at Toulouse on the first two prototypes, the **Ju 488 V401** and **V402**, which were to utilize components delivered from Germany, but further consideration of the entire project resulted in a decision to redesign the entire fuselage in order to save on strategic materials in short supply and, simultaneously, provide space for substantially larger fuel cells. Thus, work on the first two prototypes proceeded in parallel with the design of a new fuselage of welded steel-tube construction with light alloy covering for the forward and centre portions and fabric covering aft. Four additional prototypes were ordered, the **Ju 488 V403–V406** inclusive, for the proposed production model, the **Ju 488A**, which it was anticipated could attain operational service by mid-1945.

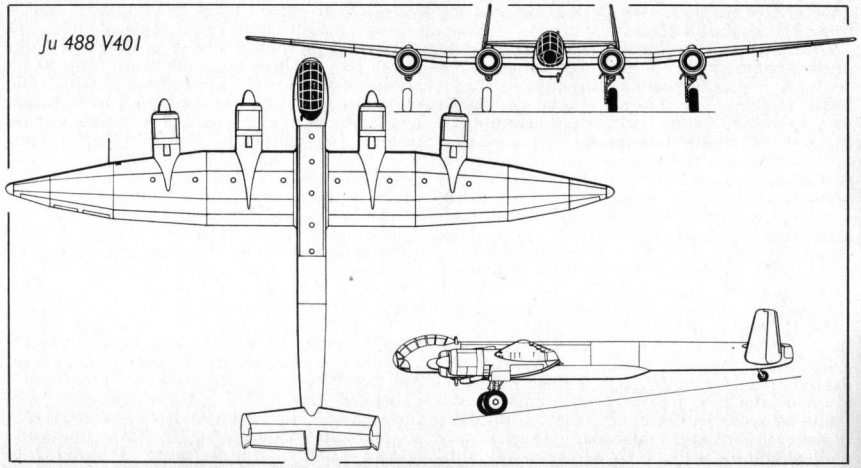
The Ju 488 V401 and V402 were each to be powered by four BMW 801TJ 14-cylinder radial air-cooled engines rated at 1,800 h.p. for take-off and 1,710 h.p. at 30,000 ft., normal and maximum fuel capacities being 900 and 1,250 Imp. gal. respectively, the latter being estimated to afford a range of 1,120 miles at maximum continuous cruising speed and 1,280 miles at economical cruise with a 4,410-lb. bomb load. Three crew members were to be accommodated in the pressurized cockpit, four main undercarriage members were to be fitted, one retracting into the tail of each engine nacelle, but neither of the initial prototypes was to be fitted with armament or other operational equipment, these being envisaged purely as aerodynamic test beds.

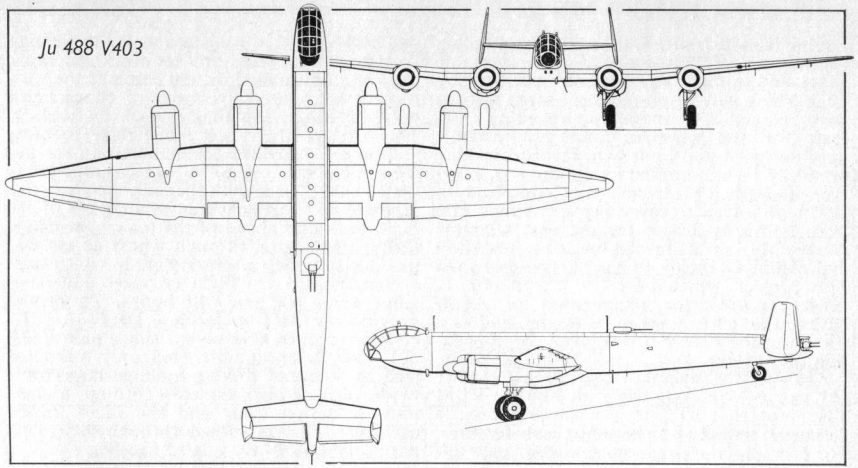
The Ju 488 V403 and subsequent prototypes were to have embodied the new fuselage which, apart from retaining the pressurized cockpit of the Ju 388K, bore no resemblance to that of the Ju 488 V401 and V402, being substantially deeper and wider, and having an overall length of 76 ft. 3 in. as compared with 66 ft. 8½ in. for the initial prototypes. The wooden ventral pannier was deleted from beneath the fuselage, and the wing moved further aft; remotely-controlled dorsal and tail gun barbettes were introduced, and the BMW 801TJ engines were supplanted by Jumo 222A-3/B-3 24-cylinder air-cooled radials. Furthermore, internal fuel

capacity and bomb load were more than doubled. Fuel was accommodated in four cells in each wing and six in the fuselage, normal and maximum fuel capacity being 2,288 and 3,314 Imp. gal., while maximum bomb load was increased to 11,023 lb.

The Dessau plant reinstated in production the tail assembly of the Ju 288C, the jigs for which had not been destroyed when the "Bomber B" programme had been cancelled in the previous year, and early in July 1944, the fuselages and wing centre sections for the Ju 488 V401 and V402 were completed at Toulouse. These components were being readied for transit by rail to the Junkers factory at Bernburg, where they were to be mated with the outer wing panels, tail assemblies and power plants that were awaiting them, when, on the night of July 16–17, 1944, French saboteurs succeeded in sabotaging the prototype fuselages, damage being too extensive for them to be salvaged.

Nevertheless, work continued on the Ju 488 V403–V406, although actual assembly had still to commence, when, in November 1944, the RLM decided to abandon the entire Ju 488 programme. The design was released for sale to Japan, but the offer was not taken up and further work at Toulouse terminated, completed components being scrapped.





JUNKERS JU 488 V403 (JU 488A) SPECIFICATION

(This specification is based on manufacturer's estimates)

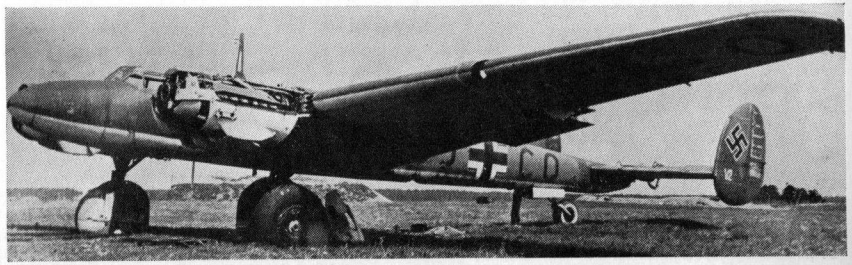
Type: *Three-seat Long-Range Heavy Bomber.* **Power Plants:** *Four Junkers Jumo 222A-3/B-3 24-cylinder radial air-cooled engines each rated at* 2,500 *h.p.* (*plus* 287 *lb. thrust for take-off and* 1,919 *h.p.* (*plus* 357 *lb. thrust*) *at* 23,620 *ft.* **Armament:** (*Defensive*) *One remotely-controlled hydraulically-operated dorsal barbette with two* 20-*mm. MG* 151 *cannon, and one remotely-controlled tail barbette with two* 13-*mm. MG* 131 *machine guns.* (*Offensive*) *Maximum bomb load of* 11,023 *lb.* **Performance:** (*Figures in parentheses relate to proposed long-range reconnaissance version*) *Maximum speed,* 338 (336) *m.p.h. at sea level,* 429 (425) *m.p.h. at* 23,620 *ft.; economical cruising speed,* 303 (298) *m.p.h.; maximum range at economical cruising speed,* 2,110 (3,180) *mls. with* 2,288 (3,134) *Imp. gal. fuel; initial climb rate,* 1,810 *ft./min.; service ceiling,* 37,240 (35,270) *ft.* **Weights:** *Empty equipped,* 46,297 *lb.; maximum loaded,* 79,366 *lb.* **Dimensions:** *Span,* 102 *ft.* 7¾ *in.; length,* 76 *ft.* 3 *in.; height,* 20 *ft.* 0 *in.; wing area,* 947.223 *sq. ft.*

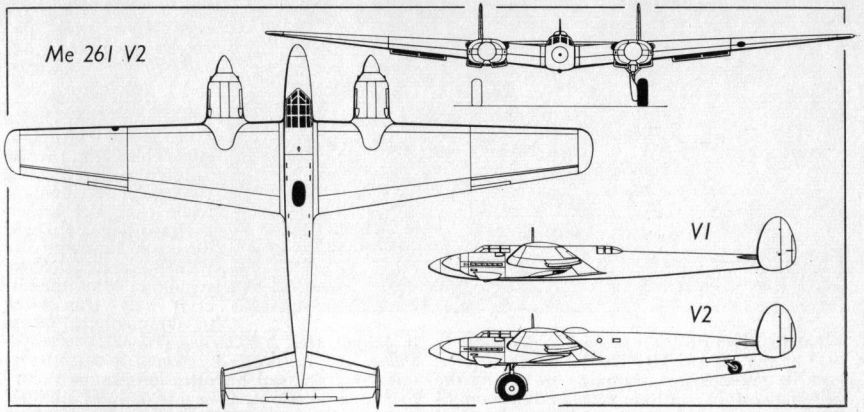
MESSERSCHMITT ME 261 GERMANY

During the late 'thirties, the rapidly expanding German aircraft industry devoted considerable effort to gaining international prestige by establishing new world records. Most records were gained by modifying existing aircraft for the purpose, and few aircraft were designed and built with record-breaking primarily in mind. One exception was, however, the Me 261, which was conceived in 1937 with a view to carrying the Olympic Fire from Berlin to Tokyo for the next Olympic Games during a record-breaking non-stop flight from Germany to the Japanese capital. This project, which bore the designation P. 1064, captured the imagination of Adolf Hitler at an early stage in its design, and as a tribute to the *Führer* it was given the appellation of *Adolfine*.

Although the general configuration of the Me 261, as the P.1064 was designated by the RLM after acceptance of the project, was orthodox, its design embodied a number of unusual features. For example, the single-spar, flush-riveted all-metal stressed-skin wing was sealed to serve as an integral fuel tank, and the thickness/chord ratio was unusually low, the depth of the wing root at approximately one-third chord being only marginally less than that of the fuselage. The fuselage itself was rectangular in cross section and provided accommodation for five crew members, the pilot and co-pilot being seated side-by-side with the radio-operator in a separate compartment immediately aft of the flight deck and ahead of the main-spar carry-through structure, through which access was possible to the aft compartment in which were accommodated the flight engineer and navigator, and a rest area with bunks. Power was provided by two Daimler-Benz DB 606A-1/B-1 coupled engines, each comprising a pair of DB 601 12-cylinder liquid-cooled units mounted side by side and driving a single large four-blade variable-pitch airscrew through a common reduction gear, and the main undercarriage members turned through 90° to lie flat in the tails of the engine nacelles.

The Me 261 *V*2, *flown in the spring of* 1941, *was used for a series of extended performance calibration trials, and was damaged at Lechfeld in* 1944.

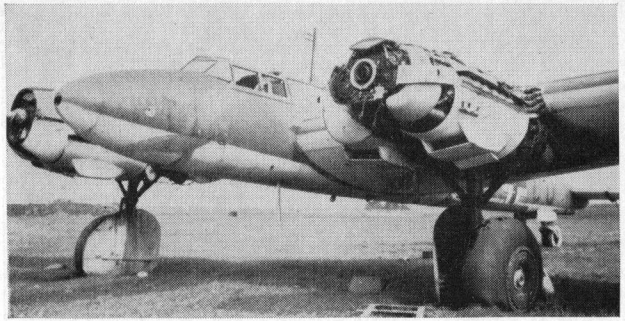




MESSERSCHMITT ME 261 V3
SPECIFICATION

Type: *Seven-seat Long-range Monoplane.* **Power Plants:** *Two Daimler-Benz DB* 610*A*-1/*B*-1 (*A*-1 *port and B*-1 *starboard*) 24-*cylinder liquid-cooled engines each rated at* 2,950 *h.p. for take-off and* 3,100 *h.p. at* 6,890 *ft.* **Performance:** *Maximum speed,* 305 *m.p.h. at sea level,* 385 *m.p.h. at* 9,820 *ft.; maximum cruising speed,* 292 *m.p.h. at* 9,820 *ft.; economical cruising speed,* 248 *m.p.h.; maximum range at maximum continuous cruising speed,* 6,200 *mls., at maximum economical cruising speed,* 6,850 *mls.; service ceiling,* 27,100 *ft.* **Weights:** *No details available.* **Dimensions:** *Span,* 88 *ft.* 1¾ *in.; length,* 54 *ft.* 8¾ *in.; height,* 15 *ft.* 5¾ *in.*

The construction of three prototypes began at Augsburg during the spring of 1939, but progress was slow owing to the low priority allocated the programme which was halted completely during the August preceding the outbreak of hostilities. Work was resumed in the summer of 1940, the first prototype, the **Me 261 V1** (BJ-CP), flying for the first time on December 23, 1940 with *Flugkapitän* Karl Baur at the controls. The second prototype, the **Me 261 V2** (BJ-CQ), was flown during the spring of 1941 when consideration was given to the possibility of using this type for ultra-long-range maritime reconnaissance tasks over the Atlantic. However, the difficulty of providing adequate defensive armament motivated against the use of the Me 261 in this role, and during 1941-42, both prototypes were used for a series of performance calibration flights over extended periods.

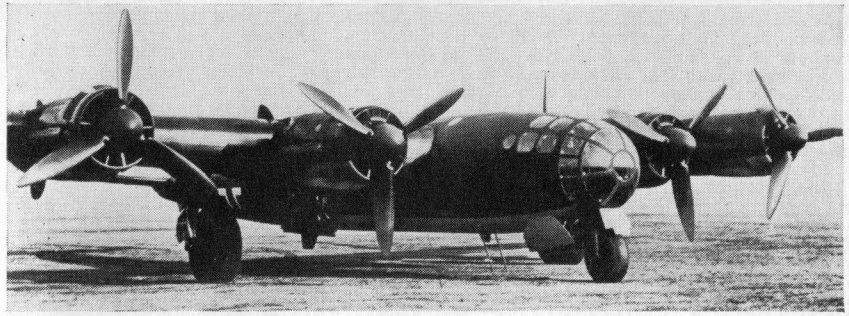


The Me 261 V2 (left), seen here with airscrews removed and DB 606 engines partly uncowled.

The first two prototypes were joined early in 1943 by the **Me 261 V3** (BJ-CR) which differed from its predecessors primarily in having the more powerful DB 610 engines and accommodation for two additional crew members, and on April 16, 1943, this third prototype was flown by *Flugkapitän* Baur over a distance of 2,796 miles in an elapsed time of 10 hours. After this flight, the Me 261 V3 suffered some superficial damage when the port undercarriage leg collapsed during a landing, and with the completion of repairs in May, the aircraft was transferred to Oranienburg where it joined the *Aufklärungsgruppe/Oberbefehlshaber der Luftwaffe* by which it was subsequently employed on ultra-long-range reconnaissance missions. The Me 261 V1 and V2 were both badly damaged during Allied bombing attacks on Lechfeld in 1944, and eventually scrapped.

MESSERSCHMITT ME 264 GERMANY

Despite the pre-war decision of the *Reichsluftfahrtministerium* (RLM) that the Messerschmitt A.G.'s design bureau and production facilities should devote their energies solely to the development and production of fighters, Professor Messerschmitt, loath to confine the activities of his organisation to one specific category of aircraft, began design studies for an ultra-long-range heavy bomber in 1940, tacitly ignoring the RLM ruling. The High Command, in considering long-term strategy and requirements, had to take into account the possibility of the U.S.A. joining hostilities and declaring war on Germany, and discussions were held with senior representatives of the aircraft industry during which was considered the effect on the morale of the American populace, in such an event, of aerial attacks on New York and other major U.S. cities direct from bases on the European continent. It was agreed that such sorties would have tremendous propaganda value even if relatively little material damage could be wrought over such an immense distance. Some thought was given to one-way missions, the aircraft participating in the sortie being ditched at a predetermined position off the American coastline after the attack, the



The Me 264 V1 was completed late in 1942, and was essentially an aerodynamic test bed fitted with Ju 88A-4 engines complete with their nacelles.

crews being picked up by submarine, but the general consensus of opinion was that the full benefit could only be derived from attacks on U.S. targets if the aircraft possessed sufficient range to regain their bases.

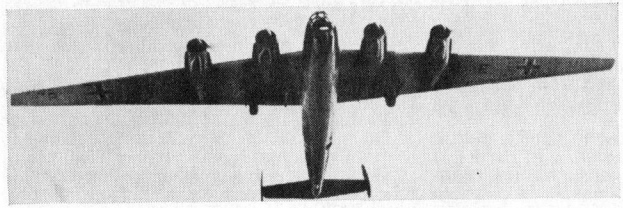
The industry was invited to submit outline proposals to the *Technische Amt* of the RLM for aircraft capable of performing the transatlantic flight in both directions without refuelling. No specification was issued, and it was stressed that the aircraft was a long-term, low-priority project. Nevertheless, Focke-Wulf, Junkers and Messerschmitt made submissions. The first-mentioned company submitted a proposal for an extended-range version of its projected Fw 300A four-engined bomber, Junkers' proposal was an extrapolation of the Ju 290 then being evolved from the Ju 90 transport, but Messerschmitt's proposal owed little to any previous project, this, the Me 264, being an exceptionally clean four-engined aircraft with a circular-section fuselage and a high aspect ratio, single-spar, long-span wing.

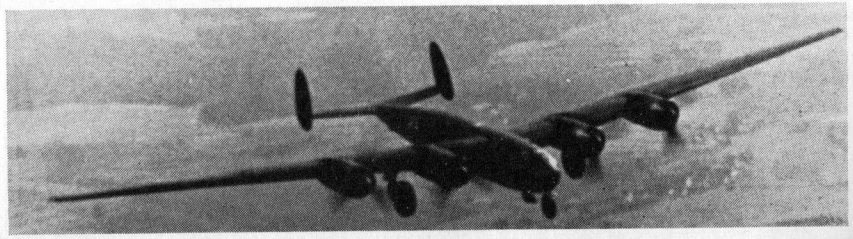
Dubbed unofficially the *Amerika-Bomber*, the Me 264 was of extremely advanced design, and although the RLM did not, at that stage of the war, consider any decision relating to such an ultra-long-range bomber a matter of urgency, requesting further project studies based on the use of six engines from all three companies that had made submissions, Professor Messerschmitt's influence was such that permission was granted for detail design to proceed and construction of three prototypes to commence.

Work on the prototypes began at Neu-Offing, near Ulm, in 1941, the first of these, the **Me 264 V1** (RE-EN) being completed late in 1942. Messerschmitt's proposal had envisaged an aircraft capable of carrying a 3,968-lb. bomb load to New York, the actual attack being performed at extreme altitude in order to avoid interception, all

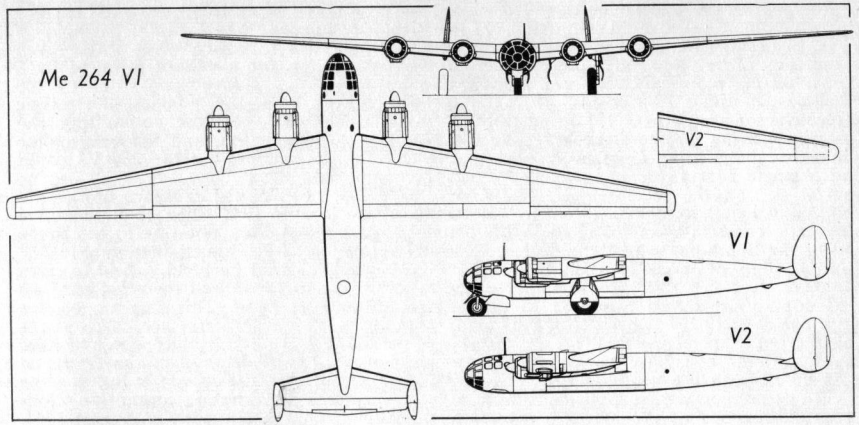
defensive armament being sacrificed in order to keep drag and equipment weight to the minimum. For simplicity, the Me 264 V1 was equipped with four Junkers Jumo 211J-1 liquid-cooled engines complete with nacelles and annular radiators as fitted to the Ju 88A-4, these each being rated at 1,340 h.p. for take-off and 1,060 h.p. at 17,000 ft. The fuselage was a circular-section monocoque structure built in three sections, the nose section containing the flight deck being extensively glazed, the tubular centre section accommodating the bomb-bay, above which was a galley, crew rest area, and walkway to the aft compartment and the tapered aft section containing an observation position. The long-span wing featured marked leading-edge taper and straight trailing edges which were entirely occupied by split flaps and ailerons, and its structure comprised a single main spar and two auxiliary spars. The single-wheel main undercarriage members retracted sideways into wells in the wing centre section, and much of the remainder of the wing envelope was occupied by fuel, self-sealing tanks containing 3,042 Imp. gal., and a further 1,287 Imp. gal. being housed by unprotected tanks.

Flown for the first time in December 1942, the Me 264 V1 was to all intents and purposes an aerodynamic test bed as, while under construction, the U.S.A. *had* entered the war, and the ideas of the *Technische Amt* of the RLM on the subject of the future *Amerika-Bomber* had crystallized. Effective defensive armament was demanded together with a





(*Left and below*) *The Me 264 V1 photographed during its initial flight test in December* 1942.



substantially increased bomb load, and the required performance could only be obtained by the use of six engines. Thus, Focke-Wulf had proposed the Ta 400 evolved from the earlier Fw 300A project, Junkers had offered the Ju 390, and Messerschmitt had tendered the six-engined **Me 264B**. The *Technische Amt* favoured the Ju 390 owing to the high order of commonality between the components of this aircraft and those of the Ju 290 already in production at Bernburg, and Messerschmitt had been instructed to modify the second and third prototypes of the Me 264 for extended-range maritime reconnaissance missions.

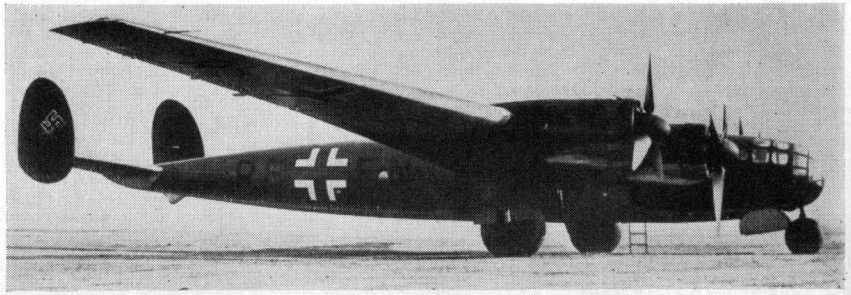
The necessary changes resulted in some delay in the completion of the **Me 264 V2** which, although structurally similar to its predecessor, differed in many respects. The *Technische Amt* requirements were not finalised until March 1943, and these dictated the replacement of the Jumo 211J-1 by BMW 801D or G 14-cylinder radials with GM 1 (nitrous oxide) injection, the provision of some 2,200 lb. of armour for the engines, crew, gun positions and the vital services, the introduction of effective defensive armament, and the provision of camera equipment and stowage for marker buoys, flash-bombs, etc. It was decided to complete the Me 264 V2 without defensive armament and operational equipment, these items being included in the **Me 264 V3** which was considered as the production prototype for the **Me 264A** series. Late in 1943, the Me 264 V2 was being readied for pre-flight ground tests when the factory was hit by an Allied bombing attack and the prototype destroyed.

Work on the Me 264 V3 continued, this

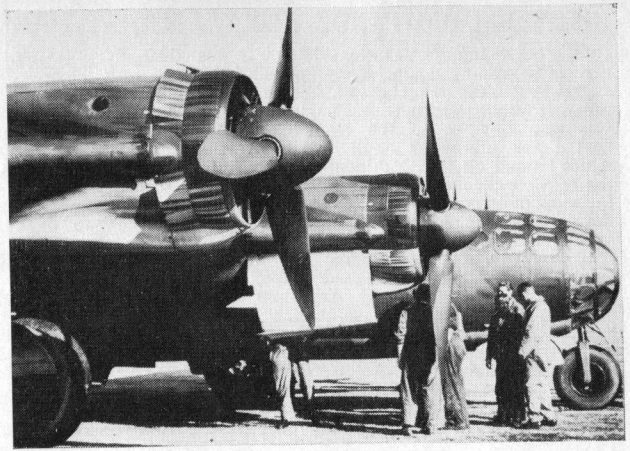
prototype, like the V2, having extended wing-tips which increased overall span from 127 ft. 7½ in. to 141 ft. 1 in., and defensive armament comprising fore and aft power-operated dorsal turrets mounting a 13-mm. MG 131 machine gun and a 20-mm. MG 151 cannon respectively, a single MG 131 firing through the nose glazing on the starboard side, two similar weapons firing from beam positions, and a single MG 151 cannon firing from a ventral step in the aft fuselage. The crew comprised eight members, three Rb 50/30 automatic cameras were mounted in the aft end of the bomb-bay which could also carry up to 4,410 lb. of bombs for the armed reconnaissance mission. For take-off under overload conditions it was proposed to add a jettisonable auxiliary wheel to each main undercarriage member, and six 2,200 lb. thrust take-off assistance rockets could be attached beneath the wings.

Various studies were conducted for more advanced versions of the Me 264, including versions powered by four and six Daimler-Benz DB 603s, four Junkers Jumo 213s, four BMW 801E or G radials plus two Jumo 004 turbojets, and four BMW 801TG radials plus two BMW 018 turbojets, while BMW even did calculations for a variant powered by a pair of BMW 028 turboprops, but by the beginning of 1944, the supplies of strategic materials militated against committing the Me 264 to production, and the programme was terminated before the Me 264 V3 could be completed.

The first news of the existence of the Me 264 came in July 1944 when an unidentified German radio station, referring to the purge of German generals, stated that an Me 264 had been readied on Lechfeld airfield to carry Adolf Hitler to Japan had the rebel generals gained the upper hand. This is as may be, but with the abandoning of further development of the Me 264, the first prototype was to have been placed at the disposal of the Osermaschinen GmbH for use as a test-bed for the steam turbine for aircraft propulsion commissioned from this company in August 1944. This steam turbine, which was intended to



The Me 264 V1 (right and opposite page) was of extremely advanced concept, and provided a practical basis for a transatlantic bomber.



drive either a 17 ft. 6 in. diameter airscrew at 400–500 r.p.m. or a 6 ft. 6 in. airscrew at 6,000 r.p.m., was to have operated on a mixture of solid and liquid fuels (65 per cent pulverized coal and 35 per cent petrol). In the event, the Me 264 V1 was destroyed in an air raid before conversion for its test-bed role could commence.

MESSERSCHMITT ME 264 V3 (ME 264A) SPECIFICATION
(Based on Manufacturer's Calculated Figures)

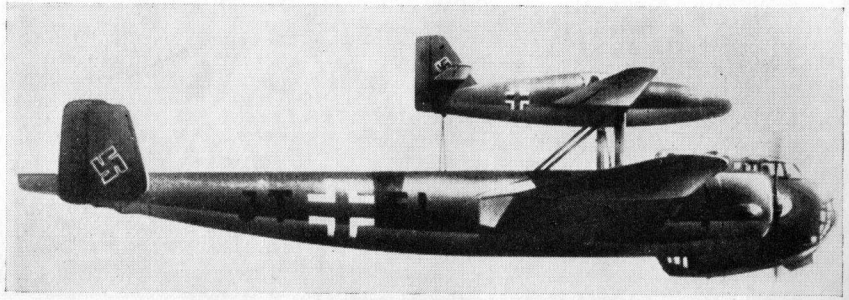
Type: *Long-range Maritime Reconnaissance-Bomber.* **Power Plants:** *Four BMW 801D or G 14-cylinder radial air-cooled engines each rated at 1,700 h.p. for take-off and 1,440 h.p. at 18,700 ft.* **Armament:** *One 13-mm. MG 131 machine gun in forward dorsal position, one 20-mm. MG 151 cannon in aft dorsal turret, one 13-mm. MG 131 firing forward through nose glazing, one 13-mm. MG 131 firing laterally from each of two beam positions and one 20-mm. MG 151 firing aft from ventral step. (Offensive) A maximum bomb load of 4,410 lb. carried internally for armed reconnaissance.* **Performance:** *Maximum speed (at 79,366 lb.), 339 m.p.h. at 20,015 ft., (at 75,840 lb.), 292 m.ph. at 27,230 ft., (with GM 1 operating), 351 m.p.h. at 27,230 ft.; normal cruising speed, 217 m.p.h. at 26,250 ft.; maximum range, 9,320 mls. at 207 m.p.h.; initial climb rate (at 123,460 lb.), 393 ft./min.; service ceiling (at 79,366 lb.), 26,250 ft.* **Weights:** *Empty equipped, 46,627 lb.; maximum loaded weight, 123,460 lb.* **Dimensions:** *Span, 141 ft. 1 in.; length, 68 ft. 6¾ in.; height, 14 ft. 1¼ in.; wing area, 1,374.55 sq. ft.*

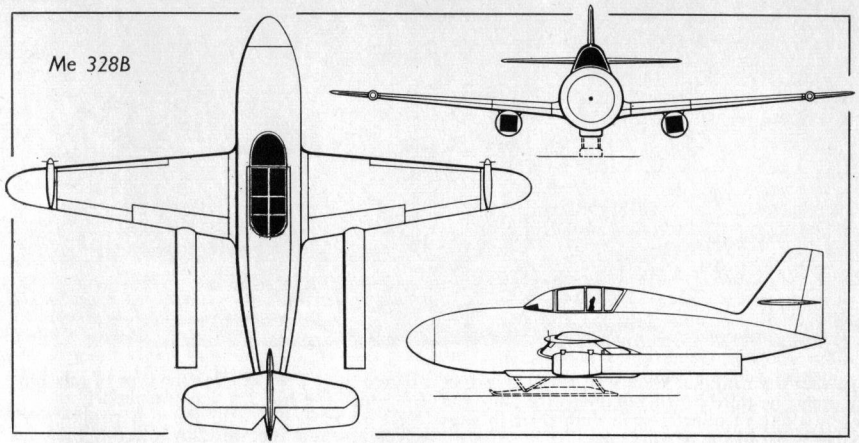
By the beginning of 1943, the tide of war was obviously turning against Germany, and the *Luftwaffe* was incurring heavy losses on almost every front on which it was committed. It was also obvious to the High Command that it was only a matter of time before the Allies landed on the Continent in force, and the tension engendered a situation in which the most unorthodox proposals for combating the forthcoming Allied landings were given serious consideration. Among these was a scheme for producing in large quantities a small, simple, inexpensive and expendable wooden aircraft, driven by Argus As O14 intermittent propulsive ducts, which would be used as a form of "flying coastal artillery".

Designated **Me 328B**, this project had been first conceived by the Messerschmitt design bureau as the *Projekt* 1079 in July 1941, when it represented the first serious proposal to apply the intermittent propulsive duct, or pulse jet, to a piloted aircraft. At this time, *Projekt* 1079 comprised a series of studies for small, air-launched or parasite aircraft, together with mounting, launching and possible retrieval systems, and these crystallized in the form of the P.1079/17 which was allocated the RLM designation Me 328.

The Me 328 was intended primarily as an inexpensive, single-sortie, expendable escort fighter for towing behind an He 177 or Me 264 bomber by means of a *Deichselschlepp*, or towing-pole. The fighter was to be released in the target area to engage enemy interceptors, its pilot subsequently baling out or endeavouring to regain friendly territory. The initial proposals submitted to the *Technische Amt* and dated March 31, 1942 envisaged three basic versions: the **Me 328A-1** with an armament of two 20-mm. MG 151 cannon and a gross wing area of 80.73 sq. ft., the **Me 328A-2** with two MG 151s plus two 30-mm. MK 103s

The DFS-built Me 328 V1 without power plants mounted above a Do 217E for initial aerodynamic trials.

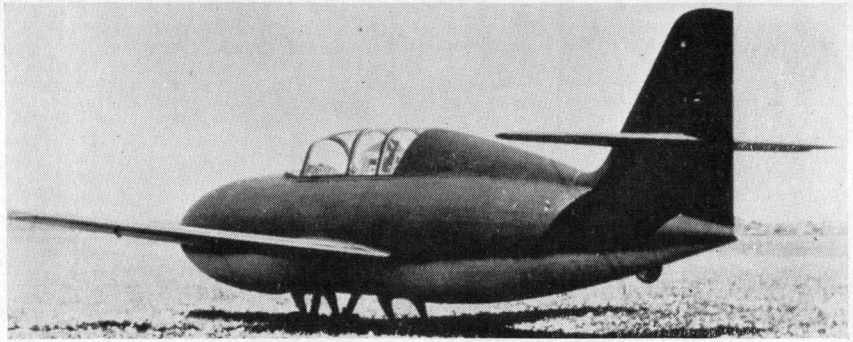




and a gross wing area of 129.16 sq. ft., and the **Me 328A-3** which was a variant of the latter with provision for in-flight refuelling. Parallel proposals were made for fighter-bomber variants designated **Me 328B-1, -2** and **-3** respectively.

Serious development began in March 1943, emphasis being placed on simplicity in order to ensure cheap and rapid production. Messerschmitt collaborated closely with the *Deutsches Forschungsinstitut für Segelflug* (DFS) in the basic design of the aircraft, and three prototype airframes were built by the DFS workshops, these having wooden wings, metal fuselages and standard Bf 109 tailplanes, although it was proposed that production aircraft should be entirely of wooden construction.

Extensive wind tunnel tests were undertaken with scale models at Augsburg to determine the best positioning for the pulse jet units. Initially, these were to have been attached by struts on each side of the fuselage aft of the wing, exhausting under the tailplane, but this scheme was soon abandoned when it was realized that the power plant's characteristic vibration would have a disastrous effect on the light wooden rear fuselage structure to which it was to be attached rigidly. Subsequently, it was decided to suspend the pulse jets beneath the wings on flexible mountings incorporating explosive bolts enabling them to be jettisoned in an emergency. Various wing positions were investigated, ranging from close inboard to mid-span, and tests were made with the power plants projecting well forward of the leading edges, and suspended



so that their intakes were well aft at approximately one-third chord, but finally the pulse jets were slung at quarter-span with their intakes slightly aft of the leading edges.

While investigation of the most suitable power plant positioning was being undertaken by Messerschmitt, seven additional airframes were constructed by the Jacob Schweyer glider-manufacturing company for static tests and aerodynamic trials, and the DFS-built Me 328 V1 had been mounted on a special rig above a Dornier Do 217E. This rig embodied strain and pressure gauges, and a number of flights were conducted during the autumn and winter of 1943 at Horsching, near Linz, Austria, before the first aerial launchings were attempted. The **Me 328 V2** and **V3** were used for a series of gliding trials for which the pulse jets were not fitted, the aircraft being released at altitudes between 9,000 and 18,000 feet, and speeds up to 465 m.p.h. being attained. Although handling characteristics left much to be desired, they were considered to be adequate for the type of missions for which the Me 328 was intended.

At an early stage in the test programme, development of the Me 328A towed-fighter was abandoned in favour of the Me 328B, and powered flight trials began early in 1944 with two 660 lb. thrust Argus pulse jets. Envisaged originally as a high-speed bomber which could double as a day fighter in an emergency, the Me 328B came to be looked upon as more an expendable piloted missile as development progressed, its primary targets being heavily-defended strong-points and ships. Virtual immunity from fighter interception was to be ensured by high speed at low altitude, which would also render it a difficult target for ground defences, and the pilot was to aim his aircraft at the target, jettisoning the rear portion of the fuselage and baling out before impact.

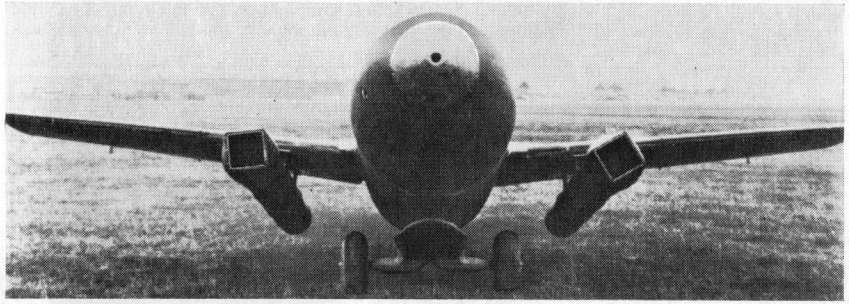
For the first tests, the Me 328 was fitted with a twin-wheel dolly which was attached to the retractable central skid, the skid being retracted and the dolly jettisoned once the aircraft was

airborne. Towed into the air behind a Do 217E, the pilot of the Me 328 cast off the towline at 9,840 ft. and started the pulse jets. Initial powered flights were anything but satisfactory. On several occasions the pulse jets had to be jettisoned, and two prototypes were lost as a result of structural failures arising from vibration initiated by the pulsation of the power plants. This problem was solved to some degree, although it had not been entirely eradicated when the development programme was terminated, but tests displayed sufficient promise for Jacob Schweyer to initiate work on a pre-production batch of **Me 328B-0** bombers.

The Me 328B featured a wooden circular-section fuselage with a maximum diameter of 3 ft. 11 in. Two 110 Imp. gal. capacity fuel tanks occupied the entire fuselage nose, and two similar tanks were housed by the rear fuselage. A 15-mm. armour bulkhead separated the cockpit from the forward fuel compartment, a 10-in. wide 15-mm. armour plate was mounted immediately ahead of the pilot, and some additional protection was provided by an 80-mm. armour-glass windscreen. Instrumentation was rudimentary, and the cockpit canopy hinged to starboard. Space did not permit provision of an ejection seat, but the whole of the rear fuselage aft of the pilot's seat could be jettisoned by means of explosive bolts to facilitate baling out. A balloon-cable cutter was provided in the extreme nose, and a retractable central skid was attached to the fuselage mainframes. Landing shocks were absorbed by a modified Fw 200C oleo leg fitted with a roller which ran on a track on the upper surface of the skid, and part of the skid was cut away at the rear to accommodate the bomb carrier. For take-off the skid was retracted and locked against the underside of the fuselage so that, although the bomb was carried by the skid, all loads were transferred to the main structure. The skid could only be extended after the bomb had been dropped.

The tapered wing was of wooden construction and was fitted with camber-changing

(Opposite page) One of the initial pre-production Me 328s used for gliding trials, and (below) an Me 328 on take-off dolly with pulse jets fitted.



flaps which, cut away to clear the pulse jets, could be deflected through a maximum angle of 50 deg. Balloon-cable cutters extended over the entire wing leading edges, and slots were fitted outboard of the power plants. The Argus As 014 pulse jets were flexibly mounted and interchangeable, and for added strength these were enclosed by outer tubes at the mounting points. The undersurfaces of the wings were protected by asbestos-covered plates, and fuel was delivered to the pulse jets by electrically-driven pumps, the current supply being drawn from an accumulator on the undercarriage until the wind-driven generators came into action.

Various methods of taking-off were proposed, ranging from a Madelung KL 12 catapult and a Borsig-designed rocket-propelled rail carriage to a Lippisch-designed three-wheel take-off trolley which could be used in conjunction with a cable-type catapult or a tug aircraft. It was proposed to replace the 660 lb. thrust pulse jets used by the prototypes and pre-production machines by 880 lb. thrust units as soon as these became available, but, in the event, the entire Me 328 programme had been terminated before the more powerful engines could be fitted.

As late as the summer of 1944, numerous alternative versions of the Me 328 were proposed, including U-boat-launched and emergency fighters mounting a nose armament of two 20-mm. MG 151 cannon with 200 r.p.g., and powered by either two 660 lb. thrust or four 330 lb. thrust pulse jets, a high-speed tactical reconnaissance model which was expected to attain 576 m.p.h. with four 660 lb. thrust pulse jets, and even a model in which the pulse jets were supplanted by a single Junkers Jumo 004B turbojet installed in the rear fuselage, but the impracticability of the pulse jet as a means of powering a manned aircraft was finally accepted, and it was suggested that, without its pulse jets, the Me 328B should be used as a piloted glider missile by 5./KG 200, an experimental unit sometimes known unofficially as the *Leonidas Staffel*. It was proposed that the Me 328B would be carried to the vicinity of its target above a converted bomber from which it would be launched to perform a gliding attack, the pilot in theory baling out shortly before impact. At an angle of 5:1 the gliding speed was 155 m.p.h., increasing to 445 m.p.h. at an angle of 12:1, but it was concluded that the converted Fw 190 fighter carrying large-calibre bombs offered a more practical proposition for such missions, and further work on the Me 328 was abandoned.

MESSERSCHMITT ME 328B SPECIFICATION

(Specification relates to aircraft with full fuel and without external load, figures in parentheses relating to aircraft with a single 2,205-lb. bomb)

Type: *Single-seat Attack Bomber.* **Power Plants:** *Two Argus As* 014 *pulse jets each rated at* 660 *lb. thrust at sea level.* **Armament:** *One* 1,102-*lb. or* 2,205-*lb. bomb externally.* **Performance:** *Maximum speed,* 434 (329) *m.p.h. at sea level,* 402 *m.p.h. at* 6,500 *ft.; range at sea level,* 391 (338) *mls. at* 430 (372) *m.p.h.; range to target at sea level and return at* 16,400 *ft.,* 466 (391) *mls.; initial climb rate at* 7,125 (9,330) *lb.,* 2,105 (492) *ft./min.; service ceiling at* 7,000 (9,150) *lb.,* 13,100 (3,610) *ft., at* 4,400 *lb.,* 22,300 *ft.* **Weights:** *Empty equipped,* 3,400 *lb.; loaded (clean),* 7,125 *lb.; maximum,* 9,330 *lb.* **Dimensions:** *Span,* 28 *ft.* 2½ *in.; length,* 22 *ft.* 4¾ *in.; height (on take-off trolley),* 5 *ft.* 11 *in.; wing area,* 101.18 *sq. ft.*

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